

Influential Factors on Selection of Implant Treatment by Patients and Their Correlation with Outcome Satisfaction

Kiarash Asadollahi ¹, Arash Golestaneh ²  , Mohsen MalekiGorji ³ , Aida Kheiri ⁴ 

¹ Private Dental Practice, Isfahan, Iran.

² Department of Oral and Maxillofacial Surgery, Dental School, Islamic Azad University, Isfahan (Khorasgan) Branch, Isfahan, Iran.

³ Department of Oral and Maxillofacial Surgery, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

⁴ Department of Periodontics, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Corresponding author:

Arash Golestaneh, Department of Oral and Maxillofacial Surgery, Dental School, Islamic Azad University, Isfahan (Khorasgan) Branch, Isfahan, Iran

drgolestaneh@gmail.com

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Abstract

Background and Aim: This study aimed to assess the influential factors on selection of implant treatment by patients and their correlation with outcome satisfaction.

Materials and Methods: This cross-sectional study was conducted on 135 patients requiring dental implant treatment. Information regarding the influential factors on selection of implant treatment by patients was collected using a valid and reliable questionnaire, and the correlation of influential factors with outcome satisfaction was analyzed by the Pearson and Spearman correlation tests. Data were analyzed by independent t-test, Kruskal-Wallis test, Mann-Whitney test, Chi-square test, and one-way ANOVA ($\alpha=0.05$).

Results: Advice from dentists was the most common reason (50.4%) for selection of implant treatment. Knowledge of patients about implant treatment had a significant correlation with their outcome satisfaction ($P=0.003$) but had no correlation with dental clinician's satisfaction with the treatment outcome ($P=0.054$). Knowledge of patients about implant treatment had a significant correlation with the time interval between the date of advice from their dentist and time of seeking dental implant treatment ($P=0.024$), and their level of education ($P<0.001$).

Conclusion: Patients had optimal knowledge level about implant treatment, and dentists had the most important role in knowledge enhancement of patients and convincing them to seek dental implant treatment. Knowledge level of patients had a significant correlation with their satisfaction with the outcome.

Keywords: Dental Implants; Patient Satisfaction; Knowledge

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Introduction

Tooth loss has a profound adverse effect on the oral health-related quality of life [1]. Dental implants are the best option for replacement of the lost teeth [2]. They are a superior alternative to removable and fixed partial dentures [3].

Dental implants can also be used to enhance the retention and stability of complete dentures. Moreover, dental implant as a replacement for fixed partial denture eliminates the need for preparation of the adjacent teeth. It also prevents alveolar bone loss and enables superior esthetic

reconstruction of anterior teeth [2]. Dental implants can provide optimal esthetics and function comparable to those of natural teeth for fully or partially edentulous patients [4].

Dental implants can be divided into two types: (I) endosteal implants which are placed in the jawbone, are mostly made of titanium, and look like a small screw. This type is the most commonly used implant type; (II) subperiosteal implants, which are placed within the gingiva either over or within the jawbone. These implants are indicated for use in patients with inadequate bone quantity who cannot or are not willing to undergo bone augmentation procedures [5]. Type of implant surgery depends on the selected type of implant and bone conditions [3].

Patients' perception of treatment is an important parameter in assessment of treatment quality, and assessment of patient expectations from treatment is an important prerequisite to maximize patient satisfaction with the outcome [6]. Patient preferences with respect to the treatment course are influenced by their viewpoints, beliefs, expectations, and goals as well as health status. Accordingly, patients consider the advantages and disadvantages, costs, and complications of different treatment options and select a treatment that best suits their needs and conditions [7]. Knowledge enhancement of patients can smoothen this process. Patients with enhanced knowledge about their condition may also question the choice of treatment suggested by their clinician [8]. Patient involvement in treatment planning is valuable given that they acquire adequate knowledge in this regard [9]. Although patients have the right to approve or reject a treatment option, clinicians play a fundamental role in helping patients to choose the best possible option. Wrong beliefs, cognitive and behavioral impairments, insufficient information, and the influence of others can greatly affect the choice of treatment of patients [10].

As mentioned earlier, patients' expectations of treatment can predict their satisfaction with the

outcome. This is particularly important in dental implant treatment [11-13]. Satisfaction accompanied by complete knowledge is a prerequisite for any therapeutic intervention. No quantitative or qualitative method is available to measure the expectations of patients. Considering the large pile of misleading information available in the social media, knowledge enhancement of patients can play a fundamental role in selection of a proper treatment by them. A previous study on a random sample of 94 patients revealed that a high percentage of patients selected their dental clinician according to the advice from the family, friends, and neighbors. Also, it was reported that dental clinicians were the main source of knowledge acquisition of patients about dental implants [14]. Furthermore, it has been shown that patient-dentist communication plays a fundamental role in patient satisfaction with the outcome. Incorrect information is one reason for unrealistic expectations of patients. Also, due to the high cost of dental implant treatment, patients often expect excellent results, which may not be achievable in many cases. Considering all the above, this study aimed to assess the influential factors on selection of dental implant treatment by patients and their correlation with outcome satisfaction.

Materials and Methods

This cross-sectional study was conducted on 135 patients requiring dental implant treatment who were selected among those presenting to three private dental offices in Isfahan, Iran in 2020. The study protocol was approved by the ethics committee of the university (IR.IAU.KHUISF.REC.1399.089).

Sample size:

The sample size for assessment of patient satisfaction with the treatment outcome was calculated to be 126 patients assuming $\alpha=0.05$, $\beta=0.1$, study power of 80%, and accuracy equal to one-fourth (0.25) of the standard deviation using the sample size calculation formula. The sample size for the assessment of the correlation between the knowledge score of patients and

their satisfaction with implant treatment outcome was calculated to be 123 patients assuming $\alpha=0.05$, $\beta=0.2$, study power of 80%, and minimum correlation coefficient of 0.25 for a significant correlation using the sample size calculation formula [15]. Considering the possible dropouts, 135 patients were enrolled.

Eligibility criteria:

The inclusion criteria were age over 18 years, willingness for participation in the study, showing up for the follow-ups, and having a history of dental implant treatment at least once.

Data collection:

To design the questionnaire, semi-structured interviews were conducted with 11 experts. Accordingly, a questionnaire was designed with 6 domains of demographic information, personal opinion regarding dental implants, personal knowledge about dental implants, familiarity of patient with dental implants and selection of dental implant type, satisfaction of patient with the treatment outcome, and satisfaction of clinician with the treatment outcome.

In the demographic information domain, patients were considered smokers if they smoked > 10 cigarettes/day. Data collection about alcohol consumption and drug abuse was based on patients' claims.

To assess the content validity of the questionnaire quantitatively, the content validity ratio (CVR) and the content validity index (CVI) were calculated. For this purpose, 11 experts were asked to assess the questionnaire. To calculate the Lawshe CVI, experts were asked to assess the question contents and rate them as necessary, beneficial but not necessary, or not necessary. The following formula was then used to calculate the CVR [16]:

$$CVR = \frac{nE - N/2}{N/2}$$

Where N is the total number of experts, and nE is the number of experts who believe that an item is necessary. Questions that scored lower than the value reported in the Lawshe's Table were omitted. Considering the presence of 10 experts in the panel of experts, questions with a CVR < 0.62 were omitted. CVI was assessed according to the validity index of Waltes and Bassel [17]. The

questionnaires were administered among 10 dental experts of the field, and they were requested to rate the questions based on relevance, simplicity, and clarity using a 4-point Likert scale as follows:

- 1: Irrelevant
- 2: Somehow relevant
- 3: Relevant
- 4: Totally relevant

The CVI was then calculated using the following formula: $CVI = (CVI_r) + (CVI_c) + (CVI_s) / 3$ and questions with a CVI < 0.79 were omitted.

The face validity of the questionnaire was also confirmed by the experts.

To assess the reliability of the questionnaire by the test-retest method, 30 questionnaires were administered among the target population. The same participants were asked to fill out the questionnaire again after a 2-week period. The reliability of the questionnaire was then analyzed as such.

The first part of the questionnaire asked for demographic information of patients. The second part had 10 statements regarding dental implant treatment. The third part of the questionnaire included 10 statements regarding dental implants to assess the knowledge level of patients in this regard.

Statistical analysis:

Data were analyzed using the Pearson and Spearman correlation coefficients, independent t-test, Kruskal-Wallis test, Mann-Whitney test, Chi-square test, and one-way ANOVA. All statistical analyses were carried out using SPSS version 22 at 0.05 level of significance.

Results

Demographics:

Table 1 presents the demographic information of the patients. The majority of the patients (36.3%) were between 26-45 years, and those > 65 years had the lowest frequency percentage (8.1%). The majority of the patients had university education (43%), and were businessmen (31.1%).

Personal habits:

Table 2 presents the frequency distribution of personal habits of the study population. A total of 62.2% of patients did not smoke, did not consume alcohol, and did not report substance abuse; 37.8% of patients reported cigarette smoking, alcohol consumption, or substance abuse; among which, cigarette smoking had the highest frequency (14.8%). Also, 48.9% reported smoking at least once daily.

Underlying conditions:

Hypertension (22.2%) was the most common underlying condition followed by diabetes mellitus (17.8%), heart disease (11.85%), osteoporosis (9.63%), and cancer (2.22%). Of all, 48.1% had no underlying condition.

Attitude towards implant treatment:

The majority of the patients agreed/totally agreed with the statements regarding dental implants being the closest replacement to natural teeth, being durable, costly, time-consuming, and worth the time, implant brand having no effect on treatment success, treatment failure being the clinician's fault, dental implants requiring care and maintenance similar to natural teeth, and dental implant treatment being painful. The majority of the patients disagreed with the statement regarding the reported success of implants being only publicity. The Wilcoxon test showed that the level of agreement of patients with the statements regarding dental implants

being the closest replacement to natural teeth ($P<0.001$), being durable ($P<0.001$), costly ($P<0.001$), time-consuming ($P<0.001$), and worth the time ($P<0.001$), implant brand having no effect on treatment success ($P<0.001$), treatment failure being the clinician's fault ($P<0.001$), dental implants requiring care and maintenance similar to natural teeth ($P=0.025$), and dental implant treatment being painful ($P<0.001$) was significantly above the moderate level, while the agreement of patients with the statement regarding the reported success of implants being only publicity was significantly below the moderate level ($P<0.001$).

Knowledge of patients about dental implants:

The findings of this section showed the frequency distribution of patient responses to knowledge questions about dental implants. The highest percentage of correct answers (74.8%) belonged to the question regarding which treatment option has the longest course of treatment in edentulous patients (the correct answer was dental implant treatment). The lowest frequency of correct answers (25.2%) belonged to the question regarding age limit for implant placement, followed by the success rate of dental implants (37.8%). The correct response was that dental implants cannot be placed for patients under 18 years of age.

Table 1. Demographic information of patients

| Variable | Category | Number | Percentage |
|-------------------|---------------------------|--------|------------|
| Gender | Female | 72 | 53.3 |
| | Male | 63 | 46.7 |
| Age | 18-25 yrs. | 27 | 20.0 |
| | 26-45 yrs. | 49 | 36.3 |
| | 46-65 yrs. | 48 | 35.6 |
| | >65 yrs. | 11 | 8.1 |
| | Below high-school diploma | 32 | 23.7 |
| Educational level | High-school diploma | 45 | 33.3 |
| | University education | 58 | 43.0 |
| | Unemployed | 37 | 27.4 |
| Occupation | Governmental employee | 37 | 27.4 |
| | Non-governmental employee | 19 | 14.1 |
| | Businessman | 42 | 31.1 |
| | Total | 135 | 100.0 |

Table 2. Frequency distribution of personal habits among the study population

| Variable | Category | Number | Percentage |
|--|-----------------------------------|--------|------------|
| Tobacco use and alcohol consumption | Cigarette smoking | 20 | 14.8 |
| | Alcohol consumption | 18 | 13.3 |
| | Traditional or industrial opioids | 3 | 2.2 |
| | Cigarette and alcohol | 10 | 7.4 |
| | None | 84 | 62.2 |
| | Total | 135 | 100.0 |
| Toothbrushing | At least twice/day | 38 | 28.1 |
| | Once a day | 66 | 48.9 |
| | I forget sometimes | 15 | 11.1 |
| | Whenever I remember | 16 | 11.9 |
| | Total | 135 | 100.0 |

In total, the knowledge level was poor in 25.2%, moderate in 32.6%, and optimal in 42.2% of the patients. The mean knowledge score of the participants was 5.40±2.76 (range 0 to 10).

Familiarly with dental implants:

Of all, 43.7% reported that their dentist/hygienist familiarized them with dental implants; 27.4% reported family and friends, 17.8% mentioned the social media, 5.9% reported their personal research, and 5.2% reported advertisements as their main source of acquaintance with dental implant treatment. When asked about the method of knowledge enhancement by their dentist/hygienist, 55.6% reported verbal explanation, 31.1% reported verbal explanation plus images and demonstration on a phantom, 7.4% reported brochures, 4.4% reported suggestion of some websites, and 1.5% reported interviewing other patients to gain knowledge about dental implants. When asked about the best method of knowledge enhancement by dentist, 58.5% of patients reported verbal explanations along with image and demonstration on a phantom, 17% reported brochures, 13.3% reported websites, and 11.1% reported interviewing other patients to be the best method.

Reasons for selection of dental implant treatment:

Of all, 50.4% reported advise from their dentist, 26.7% reported advise from family and friends, 16.3% reported their own personal research, and 6.7% reported previous negative experience with dental bridges either in

themselves or others. Of all, 53.3% reported having personal research about dental treatments and implant placement, and the majority of them (36.3%) reported that the social media had moderate impact on their choice of treatment being dental implants. Of all, 64.4% had a history of previous dental implant treatment; of which, 54% reported the reason to be satisfaction with previous treatment outcome, 25.3% reported advice from their dentist, and 20.7% reported selection of dental implant treatment since it was the only option.

Of all patients, 81.5% reported a positive history of dental implant treatment in a close relative, and 96.4% of them reported their satisfaction with the treatment outcome, and 89.1% mentioned that this satisfaction encouraged them to select dental implant treatment for themselves.

Of all, 34.1% had a history of dental bridge treatment; out of which, 82.6% were dissatisfied with the results. Also, 41.5% reported bridge treatment in a close relative and 76.8% of them reported dissatisfaction with the treatment outcome, and 82.1% mentioned that this dissatisfaction encouraged them to look for an alternative option and select dental implant treatment instead of dental bridge.

Time interval between advice for dental implant treatment and seeking treatment:

This time interval was less than 1 month in 27.4%, 1-3 months in 28.1%, and > 3 months in 44.4%. Based on the data regarding the reasons

for not seeking dental implant treatment immediately after advice, high cost of treatment was the main reason (55.6%) followed by fear of surgery (26.7%) for not seeking treatment sooner.

Opinion of patients regarding the effect of different factors on dental implant success:

Of all patients, 53.3% believed that smoking, and 49.6% believed that diabetes mellitus adversely affects the success of dental implant treatment.

Satisfaction of patients with dental implant treatment outcome:

Of all patients, 98.5% were highly satisfied and 1.5% were moderately satisfied with the treatment outcome. The mean score of satisfaction was 9.22 ± 1.02 (range 5 to 10).

All dentists (100%) were satisfied with the treatment outcome. The mean score of satisfaction was 9.61 ± 0.62 (range 8 to 10).

Correlations between different parameters:

According to the Spearman's correlation test, the knowledge level of patients about dental implant treatment had a significant correlation with their level of satisfaction with the outcome ($r=0.256$, $P=0.003$). However, the knowledge level of patients about dental implant treatment had no significant correlation with level of satisfaction of dentists with the outcome ($r=0.166$, $P=0.054$). The level of satisfaction of patients and dentists was significantly correlated ($r=0.445$, $P<0.001$). No significant difference was found in the knowledge score of male and female patients ($P=0.319$). The knowledge score and age were not significantly correlated according to the Spearman's test ($r=0.030$, $P=0.734$).

Knowledge level of patients based on different factors:

According to the data, knowledge score was significantly correlated with educational level ($P<0.001$) and those with university education had a significantly higher knowledge score than those with high-school diploma ($P=0.010$) and lower level of education ($P<0.001$). Also, the knowledge score of those with high-school diploma was significantly higher than the knowledge score of those with lower level of

education ($P=0.029$). The knowledge score of patients was not significantly correlated with their occupation ($P=0.705$).

The Mann-Whitney test showed significantly higher knowledge score of patients who did personal research about dental implant treatment ($P<0.001$). Also, those with a history of dental implant treatment had a significantly higher knowledge score than those without such a history ($P=0.015$). However, knowledge score was not significantly correlated with history of dental implant treatment in relatives ($P=0.395$).

Regarding the knowledge score of patients based on their time of seeking treatment, method of familiarity with dental implant treatment, and reason for selection of dental implant treatment, it was shown that the knowledge score of patients had a significant correlation with time of seeking treatment (Kruskal-Wallis, $P=0.024$) such that those seeking treatment in less than 1 month had a significantly higher knowledge score than those seeking treatment between 1-3 months ($P=0.020$) and after 3 months ($P=0.013$); however, the difference between the latter two groups was not significant in this regard ($P=0.932$). The Chi-square test showed a significant difference in knowledge score of patients based on their method of familiarity with dental implant treatment ($P=0.010$), such that the knowledge score of patients familiarized with dental implants through their dentist or personal research was significantly higher than other groups ($P<0.05$). The Chi-square test also showed a significant correlation between the knowledge score of patients and reason of dental implant selection ($P=0.002$), and those who selected dental implants according to the advice from their relatives had a significantly lower knowledge score than other groups.

Correlation of reason for dental implant selection and time of seeking treatment:

The Chi-square test showed a significant correlation in this regard, such that this time interval was significantly longer in patients who selected dental implant treatment based on their personal research and a negative experience of dental bridge treatment, compared with those

selecting dental implants according to their dentists or relatives' advice.

Level of satisfaction of dentists with the treatment outcome based on smoking or alcohol consumption and toothbrushing of patients, and presence of underlying conditions:

As shown in Table 3, dentists had a significantly lower satisfaction with the treatment outcome in smoker patients, substance abusers, and those consuming alcoholic beverages compared with others (Mann-Whitney, $P=0.024$). The satisfaction level of dentists had no significant correlation with toothbrushing frequency ($P=0.148$) or presence/absence of underlying conditions ($P=0.398$).

Discussion

This study assessed the influential factors on selection of implant treatment by patients and their correlation with outcome satisfaction. Almost equal number of males and females were evaluated in this study. The majority of the patients were between 26 to 65 years, and they mostly had university education and were businessmen. The majority of the patients did not smoke cigarette or consume alcoholic drinks, and reported toothbrushing once a day. Also, most patients did not have an underlying condition; but among those with underlying diseases, hypertension had the highest frequency. The majority of the patients believed that dental implants are the closest option to natural teeth and are the most durable among different treatments. Also, they believed that dental implant treatment is time-consuming and costly but its high success rate is worth the time. They

were mostly against the statement that the reportedly high success rate of dental implants is publicity, and over 50% mentioned that dental clinicians are responsible for failure of treatment. Over 65% of patients agreed that dental implant treatment is painful and the majority of patients believed that dental implants require care and maintenance, and brand of implant does not affect its success rate. A significant difference existed in the attitude of patients towards dental implant treatment. Similar to the present study, Kohli et al. reported that high cost was a drawback of dental implant treatment as stated by the participants [18].

Patients in the present study had optimal knowledge level about dental implant treatment since over 50% of patients gave a correct answer to 7 out of 10 questions. The frequency of correct responses was < 50% to the remaining three questions regarding implant material, age limitation for implant treatment, and its success rate. A previous prospective study reported over 90% total satisfaction of patients with dental implant treatment within 10 years; nonetheless, due to the relative novelty of this treatment, a large group of patients still did not have sufficient information about it [11]. Unlike their study, the majority of patients had sufficient knowledge about the type and technique of dental implant treatment in the present study. Saha et al. [12] evaluated the knowledge level of 483 patients about dental implant treatment and reported that over 50% of them had no knowledge about it, which was different from the present findings, probably due to ethnic, economical, and cultural differences between the study populations.

Table 3. Level of satisfaction of dentists with the treatment outcome based on smoking or alcohol consumption and toothbrushing by patients, and presence of underlying conditions

| Variable | Category | Number | Mean | Std. deviation | Statistic | P value |
|--------------------|--------------|--------|------|----------------|-----------|---------|
| Cigarette/alcohol | No | 84 | 9.73 | 0.50 | -2.289 | 0.022 |
| | Yes | 51 | 9.43 | 0.76 | | |
| Toothbrushing | Once daily | 104 | 9.65 | 0.60 | -1.446 | 0.148 |
| | Occasionally | 31 | 9.48 | 0.68 | | |
| Underlying disease | Absent | 65 | 9.66 | 0.59 | -0.846 | 0.398 |
| | Present | 70 | 9.57 | 0.65 | | |

They also reported that dentists were the main source of information of patients about dental implants, which was in agreement with the present results. Arora et al. [19] reported that over 74% of patients in their study had no knowledge about dental implants although 68% of them had university education, which highlights no efforts of dentists and healthcare authorities to familiarize patients with this treatment option. Their results were different from the present findings, probably due to social and cultural differences between the study populations, as well as the difference in time of conduction of studies. Kamran et al. [20], in their study in Pakistan reported that the majority of patients had no knowledge about dental implants, which was different from the present findings probably due to cultural and socioeconomical differences between the two study populations. However, they reported that high cost was the main drawback of this treatment for patients, which was similar to the present results. Fakheran Esfahani and Moosaali [21] reported optimal knowledge level of patients about dental implants and mentioned that dental clinicians play an important role in knowledge enhancement of patients in this regard, which was similar to the present findings. Siddique et al. [22], in India reported that the majority of patients had adequate knowledge about dental implants as a replacement for the lost teeth. Despite the positive attitude towards dental implants, high cost was the main reason for patients not seeking dental implant treatment. Their results were in line with the present findings. AlQahtani [23] in his study in Saudi Arabia reported that over 50% of patients in his study had no knowledge about dental implants, and only a few had received dental implants. He highlighted the need for knowledge enhancement of patients in this regard. His results were different from the present findings probably due to poor awareness raised by Arab dental clinicians. Kohli et al. [18] stated that dentists are the main source of knowledge enhancement of

patients. Also, patients in their study reported that their friends and the social media mainly encouraged them to seek dental implant treatment. Moreover, 55.6% of patients reported the same feeling as natural teeth with dental implants, and 56% of Malaysian patients reported using dental implants as a replacement for the lost teeth. High cost was the major obstacle against the receipt of dental implant treatment. The present results were in line with those of Kohli et al. [18]. Yaghini et al. [24] evaluated the satisfaction level of 176 patients with dental implant treatment and reported their high satisfaction level, which was in agreement with the present results. Kinani et al. [16] reported significantly higher knowledge level of medical staff about dental implants compared with the general population, and dentists and friends were the main sources of information for patients about dental implants. Their results were in agreement with the present findings.

In the present study, the majority of the patients reported that their dentist familiarized them with dental implant treatment, followed by family and friends. Advertisements were reported by the lowest percentage of patients. Davenport et al. [25] pointed to poor advertisement for raising awareness about new advanced treatments, and discussed that patients are often informed about such treatments mainly through their physicians or friends. Similarly, Fakheran Esfahani and Moosaali [21] demonstrated that dentists had an important role in knowledge enhancement of patients about dental implants. Similar results were obtained in the present study.

The current results revealed that patients mainly received information verbally from their dentists or with images and presentation on a phantom, which indicates that patients mostly undergo treatment without having sufficient knowledge about it. According to Davenport et al. [25], patients mostly receive information about their treatment from their clinician, and there is no reliable source to be introduced to patients,

and they mainly receive such information verbally. The present results were in accordance with their findings, although the majority of patients preferred information receipt through verbal explanation along with images and demonstration on a phantom. Level of information acquired from the social media was reported to be moderate.

One important sign of satisfaction of patients with dental implant treatment is their demand for a second implant to be placed. In the present study, 64.4% of patients had a previous dental implant treatment and sought another dental implant placement. The patients reported that a positive history of dental implant treatment with satisfactory results in relatives was a major reason for them seeking dental implant treatment. Also, 82.4% of patients were dissatisfied with their dental bridge treatment. The majority of the patients also reported high rate of dissatisfaction of their relatives with dental bridge treatment, which encouraged them to seek dental implant treatment instead. The time interval between advice for treatment and seeking treatment was over 3 months in the majority of the patients mainly due to high treatment costs; similar results were reported by Kohli et al. [18].

The majority of the patients in the present study were well aware of the adverse effects of smoking and diabetes mellitus on dental implant treatment outcome. Also, the satisfaction level of patients and dental clinicians with the outcome was high, and a significant positive correlation was found between the knowledge level of patients and their satisfaction with the outcome and dental clinician's satisfaction. Age and gender had no significant effect on the knowledge score while those with university education and patients who did research in this regard had a significantly higher knowledge level about dental implants.

Unwillingness of some patients for participation in the study, patients not showing up for the follow-ups due to COVID-19 pandemic,

and incomplete questionnaires were among the limitations encountered in the conduction of this study.

Conclusion

The results of this study showed that patients had optimal knowledge level about implant treatment, and dentists had the most important role in knowledge enhancement of patients and convincing them to seek dental implant treatment. Knowledge level of patients had a significant positive correlation with their satisfaction with the outcome.

Conflict of interest

None

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