Factors affecting demand for dental implant treatment: a patient-centered observational study

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Abstract

Aim: Patients' decisions upon treatment are influenced by wide array of factors. The aim of the study was to investigate the reasons to prefer dental implants.

Methods: Clinical evaluation forms were assessed retrospectively. The reasons were analyzed with Chi-square and t-tests. The independent variables with a p value less than 0.15 in univariate analysis were selected to include into the multiple logistic regression model as potential predictors. The final model in multiple logistic regression was obtained by backward elimination technique.

Results: Data of 483 participants (364 female, 119 male) exhibited that patients with higher education level ($p<0.0001$), patients with less than 20 teeth ($p=0.044$) and patients who experienced implant surgery previously ($p=0.033$) demand implants more. Request for dental implant treatment decreases by age ($p=0.039$).

Conclusions: Preference for dental implant treatment may influence by age, education level, number of natural teeth, previous treatment experience, economic status and familiarity.

Keywords: dental implant; patient expectations; patient-centered.

Introduction

Complex nature of the decision making include many factors inside and outside of the clinical settings (e.g. economic, social, cultural background) (Jayasinghe *et al*., 2017, Alzahrani and Gibson, 2018). The extent of knowledge, perceptions and beliefs are some of the substantial determinants of patients' perspective on a particular treatment (Ozcakir Tomruk *et al*., 2014). Favourable or unfavourable experiences of patients or their relatives affect their attitudes substantially. Besides, the opinion towards a treatment is being shaped widely by media products.

Dental implants are one of the most preferred treatment options for rehabilitation of partial or complete edentulism (Esposito *et al*., 2010). Extensive amount of basic and clinical research is present in the literature including success and failures, risk factors, loading protocols, surgical approaches and healing, esthetic considerations, augmentation procedures (Chen *et al*., 2013, Jimbo and Albrektsson, 2015, Huynh-Ba *et al*., 2018, Bosshardt *et al*., 2017, Topcu *et al*., 2017, Moy and Aghaloo, 2019). Among them, patients' perceptions and reasons of choice are yet under researched.

Success criteria for implant treatment significantly changed over time. Patients' perceptions and attitudes regarding outcomes began to gain further importance (Al-Dwairi *et al*., 2014, Ozcakir Tomruk *et al*., 2014). Success is affected by patients' extent of knowledge, awareness and familiarity to the treatment (Saha *et al*., 2013). Limited knowledge (e.g. on impact of poor oral hygiene) is underlined as one of the reasons of failure (Pommer *et al*., 2011). However, patient centered data regarding dental implant treatment is still scarce.

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The objective of the present study was to evaluate the factors that cause a tendency towards dental implants from the patients' perspective.

Materials and Methods

Data

The study has cross-sectional and retrospective design and the study method was approved by University Ethical Committee with the protocol number GO 17/179-28. Study conforms to the STROBE guidelines for human observational studies.

Routinely used patient examination forms in undergraduate student clinic of Faculty of Dentistry were the sources of data. As a part of the formal dental curriculum, 4th and 5th grade dental students receive their periodontal training and clinical education in this clinic. Each student is required to examine the patients, fill a patient examination form and present all the information gathered on this form to the supervisor (specialists, faculty in the department) before any periodontal treatment. This forms include detailed information about demographics, medical and dental history, extraoral examination, examination of intraoral soft tissues and teeth, detailed periodontal examination, information about patients' oral hygiene habits, consumption habits (cigarette, alcohol, coffee-tea etc.), radiological examination findings, implant history, need for a prosthetic treatment, reasons for demand or non-demand for implant treatment, periodontal diagnosis, possible etiological factors, treatment plan and prognosis.

Data of the patients with at least one edentulous space were included. Demographic data, awareness on their periodontal health status, frequency of dental visits, oral hygiene practices, reasons of tooth losses were recorded. Questions focusing on reasons of demand or non-demand were assessed. At the relevant section of the interview, students directed the question, ''Do you consider implant/s for the rehabilitation of the edentulous space/s?" One or more of the following options were chosen by the student regarding to patient's response:

Motivations for willingness were grouped as; demand for fixed prosthesis, improved esthetics, improved quality of life and improved function.

Reasons for not to consider implants were grouped as; limited knowledge/information regarding implant treatment, anxiety for surgery, cost considerations, and positive attitude towards use of removable prosthesis.

Statistical analysis

Statistical data was processed using IBM SPSS Statistics for Windows, Version 24.0 (IBM Corp., Armonk, NY, USA). Mean values and standard deviations were used for descriptive statistics for continuous numerical variables. Categorical variables were presented as number of event and percentage. Student's t-test was used for the average of independent pairs. Evaluation of categorical variables was performed by chi-square test. The independent variables with a p value less than 0.15 in univariate analysis were selected to include into the multiple logistic regression model as potential predictors. The final model in multiple logistic regression was obtained by backward elimination technique. The assessments were based on comparisons with a statistical significance of 0.05.

Results

Demographics

Among 1126 forms scanned, 483 found eligible, which belong to individuals who had edentulous space requiring rehabilitation. Remaining 643 forms were excluded either due to lack of edentulism or unfilled questions. Data regarding age, gender, educational status and oral hygiene practices of participants (364 female, 119 male) are provided in Table 1. Mean age was 43.11±13.77. The difference between females (41.95±13.02) and males (46.65±15.37) was significant (p=0.003).

While 211 patients (43.7%) with at least one edentulous space had demand for implants, more than half of the patients (n=272, 56.3%) were considering options other than dental implant supported prostheses (Table 1).

Determinants of demand

Gender, age, and educational status

Demand for implants decreased significantly with older ages (p=0.039) and patients with higher education levels demanded implants significantly more (p<0.0001) (Table 1).

Number of natural teeth

The most prevalent reason of tooth loss was decay (416 patients), followed by periodontal disease (41 patients). One of the determinants to consider dental implant was number of natural teeth. Out of the 103 patients who hold <20 natural teeth, thirty-six (35%) were demanding implants. However, the majority of them (n=67, 65%) were preferring for other prosthetic options (e.g. bridges, tooth or soft tissue supported dentures). Out of the 375 patients with ≥20 natural teeth, 173 patients (46.1%) were demanding for implants and 202 patients (53.9%) were not considering. Patients with ≥20 natural teeth had significantly pronounced request towards dental implant treatment compared to the patients with <20 teeth (p=0.044).

Having complaint on periodontal status

One of the questions included in the examination form was "do you think that you have gum disease?. Out of 247 patients who had (51.2%) complaint over periodontal status, 114 (46.2%) were demanding implants. Two-hundred and thirty-five patients (48.8%) were not thinking that they had gum disease and

Table 1. Data regarding age, gender, educational status and oral hygiene practices.

Parameters	Having demand for dental implant	Having no demand for dental implant	p-value	Total
Age range (years)			0.039*	
18-29	54 (55.7%)	43 (44.3%)		97 (100%)
30-49	98 (42.8%)	131 (57.2%)		229 (100%)
50-64	46 (38.7%)	73 (61.3%)		119 (100%)
>65	13 (34.2%)	25 (65.8%)		38 (100%)
Education level			0.000*	
Primary education or less	45 (33.8%)	88 (66.2%)		133 (100%)
Secondary education	71 (39.0%)	111 (61.0%)		182 (100%)
High education	95 (56.5%)	73 (43.5%)		168 (100%)
Gender			0.825	
Female	159 (43.7%)	205 (56.3%)		364 (100%)
Male	52 (43.7%)	67 (56.3%)		119 (100%)
Toothbrushing technique	0.153			
Correct	51 (54.3%)	43 (45.7%)		94 (100%)
Incorrect	158 (42.9%)	210 (57.1%)		368 (100%)
Toothbrushing frequency			0.161	
Once a day	92 (47.9%)	100 (52.1%)		192 (100%)
Twice a day	81 (44.3%)	102 (55.7%)		183 (100%)
Three times a day	11 (42.3%)	15 (57.7%)		26 (100%)
Irregular	19 (41.3%)	27 (58.7%)		46 (100%)
Using dental floss			0.168	
Yes	39 (51.3%)	37 (48.7%)		76 (100%)
No	172 (42.6%)	232 (57.4%)		404 (100%)
Using interdental brush			1.000	
Yes	14 (43.8%)	18 (56.3%)		32 (100%)
No	197 (44%)	251 (56%)		448 (100%)

* The difference between the patients who demand/nondemand for dental implants according to the parameters was statistically significant ($p<0.05$).

96 (40.9%) of them were demanding implants (One patient did not provide any information). Having a complaint on periodontal status did impacted demand or non-demand (p=0.270).

Oral care practices

We summarized patients' oral care practices in Table 1. Neither brushing frequency (p=0.161) nor usage of dental floss (p=0.168) or interdental brush did not impact patients' demand for dental implants (p=1.000). Frequency of dental visits was also unrelated with patients' demand. Most of the patients reportedly visit dentist upon on a complaint (376 patients, 78%) or with irregular time intervals (48 patients, 10%), while 58 patients (12%) reportedly visit dentist annually (p=0.620).

Possessing implant supported prosthesis

Patients who already possess dental implants (n=23) showed tendency for additional ones compared to patients who lack previous implant experience (p=0.033). Twenty-three patients (4.8%) had a previous dental implant experience. Out of 23 patients who possess implants in function, 8 (44.4%) declared that they regularly visit dentist for follow-up.

Perceived reasons for the demand

The main reason of demand was improved quality of life (95 patients, 45%) followed by improved function (91 patients, 43.1%), demand for fixed prosthesis (70 patients, 33.2%), and improved esthetics (54 patients, 25.6%). Ten patients (4.7%) declared other reasons including 'thinking dental implants are good', 'avoidance from tooth preparation' and 'dental implants were recommended'. Demand for fixed prosthesis (p=0.397) and improved quality of life (p=0.038) were expressed more frequently by males, while improved chewing function was the primary reason for females. The reason of demand for fixed prosthesis was expressed more often by the patients with ≥20 teeth (71.4%) than patients with <20 teeth (28.6%) (p=0.003). All the reasons for the demands for dental implant was expressed more often by the patients holding higher educational degree.

Perceived reasons for the non-demand

Cost consideration was the primary reason of reluctance to dental implants (158 patients, 58.1%). Other reasons were anxiety about surgery, limited knowledge/information and a positive attitude towards the use of removable prosthesis (Table 2). Although limited knowledge/information was expressed significantly more by patients who hold ≥20 teeth (p=0.013) and by younger patients (p<0.0001), positive attitude towards use of removable prosthesis remarked as the reason particularly by elderly patients (p=0.024). Patients who hold higher educational degree, emphasized their anxiety for surgery significantly more (p<0.0001). Cost consideration was expressed more often by patients holding lower educational degree (p<0.0001) (Table 2).

Analysis of combined effect of the parameters on demanding/non-demanding reasons

Patients with higher education level were more willing to implant treatment compared to ones with primary (2.5-times) and secondary (2-times) school graduates. Patients with implant in their mouth was demanding additional ones 2.5-times more.

Discussion

We aimed to assess the patients' attitudes towards dental implant treatment and the factors affecting preference for dental implants. Outcomes underlined age, educational status, economic situation and number of natural teeth as the potential determinants of demand for implant.

Younger patients opt for dental implants for rehabilitation of missing teeth, which is in concordance with a previous questionnaire study performed by Pommer *et al*. (2011), which reported that patients over 50 years of age rejecting implant treatment significantly more, compared to younger ones. Moreover, according to a study in Germany (Müller *et al*., 1994), very old age was the most common reason for rejecting implants, discussed as elderly patients tend to accept and adapt to loses of masticatory function better. There is a negative correlation between age and functional expectations (Baracat *et al*., 2011). Furthermore, elderly patients have greater likelihood to be in a need of higher quantities of dental implants due to fewer remaining natural teeth, which adds further importance to treatment costs and requirement for extensive surgeries.

Table 2. The reasons of demanding/nondemanding for dental implant procedures based on gender, education level, and number of natural teeth.

	Gender			Education Level				Number of natural teeth			
	Female n (%)	*Male n (%)*	*p-value*	*Primary education or less n (%)*	*Secondary education n (%)*	*Higher education n (%)*	*p-value*	*<20 teeth n (%)*	*≥20 teeth n (%)*	*p-value*	*Total*
Reason of demanding for dental implants											
Demand for fixed prosthesis	50 (71.4%)	20 (28.6%)	0.397	19 (27.1%)	19 (27.1%)	32 (45.8%)	0.208	20 (28.6%)	50 (71.4%)	**0.003***	70 (100%)
Improved esthetics	43 (79.6%)	11 (20.4%)	0.467	8 (14.8%)	18 (33.3%)	28 (51.9%)	0.415	9 (16.7%)	45 (83.3%)	1.000	54 (100%)
Improved quality of life	65 (68.4%)	30 (31.6%)	**0.038***	19 (20%)	30 (31.6%)	46 (48.4%)	0.692	15 (15.8%)	80 (84.2%)	0.465	95 (100%)
Improved function (Chewing)	70 (76.9%)	21 (23.1%)	0.747	25 (27.5%)	30 (33%)	36 (39.5%)	0.074	34 (37.4%)	57 (62.6%)	0.712	91 (100%)
Reason of nondemanding for dental implants											
Limited knowledge/ information regarding dental implant treatment	33 (78.6%)	9 (21.4%)	0.226	8 (19%)	22 (52.4%)	12 (28.6%)	0.174	5 (11.9%)	37 (88.1%)	**0.013***	42 (100%)
Anxiety for surgery	44 (77.2%)	13 (22.8%)	0.859	8 (14%)	22 (38.6%)	27 (47.4%)	**0.000***	13 (22.8%)	44 (77.2%)	0.483	57 (100%)
Cost consideration	118 (72.4%)	45 (27.6%)	0.396	63 (38.7%)	68 (41.7%)	32 (19.6%)	**0.001***	43 (26.4%)	120 (73.6%)	0.392	163 (100%)
Positive attitude towards use of removable prosthesis	12 (57.1%)	9 (42.9%)	0.052	7 (33.3%)	8 (38.1%)	6 (28.6%)	0.983	15 (71.4%)	6 (28.6%)	**0.000***	21 (100%)

* The difference between subgroups was statistically significant (p<0.05).

In literature, more patients with higher education level reported to have demand for implant rehabilitation (Kohli *et al*., 2014, Ozcakir Tomruk *et al*., 2014, Satpathy *et al*., 2011). Study by Ozcakir-Tomruk *et al*. (2014) in Turkish population, reported that awareness for need of care rises by increasing level of education. Results of our study also exhibited education level as one of the most powerful factors affecting implant demand. Which is attributable to better economic status and concern for self-care.

Improved quality of life (45.0%) was the chief reason for demand. Implant supported prostheses come to forefront with superior function and esthetic results compared to conventional prosthetic options. Tepper *et al*. (2003) reported higher satisfaction rates with implant supported prostheses, compared to removable and conventional fixed prostheses.

Improved function came forward as the second reason with 43.1% of patients, followed by improved esthetics (25.6%). Restoration of masticatory function is one of the major expectations from implants (Al-Dwairi *et al*., 2014, Jayasinghe *et al*., 2017). Rustemeyer and Bremerich (2007) reported that as 80% of the patients load great importance to the function, 54% add importance mainly to the esthetics. A previous study reported that one-third of the patients feel closing the gap is necessary only if the gap is visible (Pommer *et al*., 2011). A study in German population (Rustemeyer and Bremerich, 2007) emphasized that women give more importance to esthetic appearance. However, a study in Brazilian population did not find a difference between men and women in either esthetic nor functional expectations (Baracat *et al*., 2011), similar to the present results.

Preference for a fixed prosthesis is another important driver to choose implants. Patients with less than 20 teeth stated need for improved function as the primary reason, while the ones without demand expressed their economic status. Previous studies also reported high preference for fixed prosthetic rehabilitation (Al-Johany *et al*., 2010, Ozcakir Tomruk *et al*., 2014, Pommer *et al*., 2011, Tepper *et al*., 2003, Satpathy *et al*., 2011). We also observed a rising trend towards demand, as patients' number of missing teeth increases.

Treatment costs affect preference among treatment options. People perceive dental implants as an 'expensive' treatment model (Tepper *et al*., 2003). In our study cost-consideration was the primary reason to avoid implants. The second most common reason was anxiety for surgery. Some previous studies (Al-Dwairi *et al*., 2014, Satpathy *et al*., 2011) reported the same top two motives. Marketing-oriented researches performed in Austria (Tepper *et al*., 2003) and Canada (Srivastava *et al*., 2020) proposed that interest in implants and willingness to pay for treatment rise with increasing family incomes. Another study in Turkish population (Ozcakir Tomruk *et al*., 2014) also reported that patients abstain from implants due to high cost. However, most of these studies were performed in university hospital clinics or public hospitals, where patients receive health service mostly paid by their social security, except implant therapy.

Patients with previously made implants had positive attitude for additional ones. Which may be discussed as some patients are reluctant to implant therapy due to limited knowledge. Sixty-percent of the patients, whose friends had positive experiences, were willing for implant therapy, previously reported (Rustemeyer and Bremerich, 2007). One trial reported that primary reason of avoidance was "fear of unknown side effects" (Al-Dwairi *et al*., 2014).

Insufficient knowledge about nature and performance of implants may also lead to unrealistic expectations. Nineteen-percent of our study population avoid from implants due to limited knowledge/information, particularly younger group. Level of information largely affected by socioeconomical characteristics of the studied population. Results of previous studies in India indicated that more than half of the patients had no information on implants (Saha *et al*., 2013, Mayya *et al*., 2018). On the other hand, a Norwegian study (Berge, 2000) presented high level of awareness (96%) for implants. However, 64% of their study population considered themselves as inadequately informed.

In our population, implant demand or reluctance do not differ regarding their dental care routines. Substantial number of patients (Rustemeyer and Bremerich, 2007, Ozcakir Tomruk *et al*., 2014) were estimating similar care with natural teeth. Over two-thirds of the patients did not know about care of dental implants or reasons of failures (Al-Dwairi *et al*., 2014). Besides, most of the patients expect from implant to last more than 10 years (Kohli *et al*., 2014, Ozcakir Tomruk *et al*., 2014, Rustemeyer and Bremerich, 2007). This findings indicate that dentists should take more responsibility to explain the process, expected results, and post-treatment care and follow-up with emphasizing the differences between natural teeth and dental implant supported prostheses.

As a limitation, fully edentulous patients were not included to the study because they are not referring to Periodontology Clinic. Which left an important proportion of older population out of assessment. Secondly, evaluation forms were fulfilled not by a single researcher but hundreds of students, which hamper standardization. On the other hand, lack of a single operator reduces bias by concealing the predominant reasons until the data entry. Thirdly, the retrospective design obstructs to draw a line between demand initiated by patients themselves and demand induced by dentist's question "do you consider implant?". Patients' varying knowledges on available prosthetic options or surgical requirements might cause difficulties for clear interpretation of the results.

Considering the social, economic and psychological aspects of decision-making, this study offers a perspective based on a population seeking dental treatment in a University Hospital. Results can be attributed to general population with its limitations. Future researches may reach to more generalizable results by evaluating larger populations in multiple centers or community out of clinical setting.

Conclusion

According the results of the present study, patients' demand for implant supported prostheses is affected by characteristics such as age, education level and number of natural teeth present in the mouth. While, primary reason for demand was expectation for an increased life quality, chief reason for the reluctance was the cost. On the other hand, perspective for removable prosthetic option is an important factor for dental implant request for patients with multiple tooth losses and elderly individuals.

As dental implant treatment is becoming more of a treatment choice, dental professionals need to be familiar with the decision-making process of their patients and their perceptions towards treatment. Patients' examination to understand their perspective on therapy is essential for successful outcomes.

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