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ORIGINAL ARTICLE

Impact of Tooth Loss and Preferences for Tooth Replacement Among Clinic Attendees at a Public University

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ABSTRACT

Tooth loss is considered a major end-point sequela of preventable oral diseases. In Malaysia, tooth mortality is a common oral health problem. **Objective:** To assess the impact of tooth loss, preferences for tooth replacement, and the relationship between impact of tooth loss and number of missing teeth. **Methods:** This descriptive cross-sectional survey involved 244 patients attending a primary health center and dental clinic at a public university. The respondents completed self-administered questionnaires on personal background, tooth replacement status, impact of tooth loss using a 12-item modified Geriatric Oral Health Assessment Index (GOHAI), and preferences for tooth replacement. A dental examination was performed to determine the number of missing teeth. **Results:** The mean age of the respondents was 56.2 years (standard deviation [SD], 8.1 years). The mean number of missing teeth was 8.3; 62.7% of patients had at least 20 natural teeth. The majority were not wearing a dental prosthesis. The mean GOHAI score was 16.3. Of the patients, 66.0% experienced some food biting difficulty, 59.4% worried about oral health, and 57.8% experienced eating discomfort. Dental implants were the most preferred replacement option (38.9%). The GOHAI scores were not related to the number of missing teeth. **Conclusion:** Tooth loss and use of dental prostheses had some impact on quality of life, although the impact was not high.

Key word: preferences for tooth replacement, quality of life, tooth loss

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INTRODUCTION

Tooth loss is considered a major end-point sequela of preventable oral diseases. In Malaysia, tooth mortality is a common oral health problem. Only 76.9% of 35- to 44-year-old and 23.9% of 60- to 70-year-old individuals have at least 20 functional teeth remaining.[1] Among the dentate population, the mean number of teeth was 24.5 in 2000 and remained constant in 2010.[2] Some causes of tooth extraction include caries, periodontal disease, trauma, infection, or orthodontic treatments.[3–6] Some individuals find tooth loss extremely traumatic and upsetting,[7,8] and a number of patients undergo real or perceived detrimental emotional, social, physical, and psychological effects that greatly influence their quality of life.[9,10]

Despite these effects, not all patients seek treatment with dental prostheses after losing their teeth. The Malaysian National Adult Oral Health Survey indicated that only a quarter of participants had a prosthesis when, in fact, approximately half were assessed to be in need of one.[2] Some studies cited functional, physical health benefit, social, and psychological reasons for replacement of missing teeth.[11,12] In addition, financial constraints may affect treatment-seeking decisions and selection of prosthodontic treatment options.[13] Other factors known to affect the need or demand for prosthodontic treatment include age, sex, socioeconomic status, educational level, and appearance.[14]

A recent study reported that only a quarter of Malaysians visited a dental clinic within the past year, and fewer still among the low-income group.[2] Nonetheless, patient contact with medical personnel is higher, especially with the increase in incidence of noncommunicable diseases (NCDs). NCDs are the leading cause of death and morbidity worldwide, currently contributing to an estimated 73% of total deaths in Malaysia, with

the largest contributor being cardiovascular diseases, including heart attacks and strokes. The Second Burden of Disease Study for Malaysia, published by the Institute for Public Health in 2012, ranked hypertension, smoking, diabetes, high cholesterol, and high body mass index as the greatest contributors to disability-adjusted life years and death.[15] Chronic diseases place a substantial economic burden on the sufferers, and having to deal with impact of tooth loss or pay for prosthodontic treatment may pose an added burden.

Few investigators have assessed the population impact of tooth loss and replacement of teeth in Malaysia. We determined the relationship between tooth loss impact and preferences for replacement of teeth among patients in a selected population. The findings could be used to provide a baseline to further improve public awareness of tooth loss prevention and tooth replacement options. Our objectives were to investigate the impact of tooth loss, preferences for tooth replacement, and the relationship between impact of tooth loss and number of missing teeth among patients attending clinics at a public university.

METHODS

Ethics approval and participant recruitment

We obtained ethics approval to conduct this study from institutional review board for Research and Ethics (PPI/111/8JEP-2017-200). This descriptive cross-sectional study using self-administered questionnaires was performed at Universiti Kebangsaan Malaysia Faculty of Medicine Primary Care Clinic and Faculty of Dentistry Primary Dental Clinic. During data collection, patients who were present at either location and met the inclusion criteria (age at least 35 years, with at least one missing tooth and at least one type of NCD, Malaysian) were invited to participate in the study. All participants were briefed about the study and signed the informed consent form before participation. The convenient sampling methodology was adopted. Sample size was calculated based on the proportion of adults with missing teeth in the 35–64-year age group during the National Oral Health Survey for Adults in 2010 (33.6%), with a 5% level of significance and an 80% study power.

Questionnaire survey

Participants completed a set of questionnaires on age, sex, educational status, household monthly income, medical conditions, status of tooth replacement, impact of tooth loss, and preferences for tooth replacement. The impact of tooth loss was measured using a modified 4 Likert scale, and a 12-item Geriatric Oral Health Assessment Index (GOHAI), which had been validated for use in the Malay language. To evaluate tooth replacement preferences, pictures of bridges, dentures, and dental implants were shown to the participants, and brief descriptions were given for each option. They were then asked to rank their most to least preferred options. Next, the average dental costs for each tooth replacement option were provided, following which participants were asked to rank their preferences again. We also asked the participants to indicate the amount of treatment cost they were willing to pay for each treatment option. Before the survey, the questionnaire was pretested with 30 adults with matching criteria from Hospital Kuala Lumpur to assess clarity and estimate the time needed to complete the questionnaire.

Table 1. Background of study respondents

Patient characteristics (*N* = 244)	n	%
Age (mean ± SD)	56.2 ± 8.1	
Sex		
Male	121	49.6
Female	123	50.4
Highest education level		
Primary	17	7.0
Secondary	120	49.2
Tertiary	107	43.8
Income		
RM0–2000	89	36.3
RM2001–5000	77	31.6
RM5001–10,000	57	23.4
>RM10,000	21	8.6
Medical problem		
Diabetes mellitus	97	39.8
Hypertension	151	61.9
Hypercholesterolemia	114	46.7
Stroke	11	4.5
Mental	2	0.8
Asthma	10	4.1
Others	32	13.1
Tooth replacement status		
Replace with prosthesis		
Bridge	17	7.0
Denture	70	28.7
Implant	7	2.9
Did not replace	152	62.3

Oral examination

A brief oral examination was conducted to assess the number and site of missing teeth as well as type of prosthesis worn, if any. Dentures were removed before examination. If a bridge was present, we did not consider pontics as teeth. A tooth was regarded as missing when no part of it was visible. Third molars were not accounted for in this study.

Data analysis

Data were tabulated and calculations made using Microsoft Excel 2010 (Microsoft, Redmond, WA, USA). We performed descriptive analysis to answer the study objectives. For correlation, the level of significance was set at 5%.

Table 2. Frequency distribution of responses on individual GOHAI items

No. Item	0 Never *n* (%)	1 Seldom *n* (%)	2 Sometimes *n* (%)	3 Often *n* (%)	4 Always *n* (%)
Sensitive to hot, cold, or sweet foods	70 (28.7)	47 (19.3)	103 (42.2)	14 (5.7)	10 (4.1)
Used medication to relieve pain	151 (61.9)	52 (21.3)	37 (15.2)	2 (0.8)	2 (0.8)
Limit the kinds or amount of food	123 (50.4)	44 (18.0)	53 (21.8)	20 (8.2)	4 (1.6)
Able to eat without discomfort	11 (4.5)	30 (12.3)	54 (22.1)	46 (18.9)	103 (42.2)
Able to swallow comfortably	6 (2.4)	10 (4.1)	10 (4.1)	37 (15.2)	181 (74.2)
Trouble biting or chewing	83 (34.0)	33 (13.5)	83 (34.0)	32 (13.2)	13 (5.3)
Unable to speak clearly	173 (70.9)	42 (17.3)	22 (9.0)	5 (2.0)	2 (0.8)
Limit contacts with people	201 (82.4)	29 (11.9)	10 (4.1)	3 (1.2)	1 (0.4)
Uncomfortable eating in front of others	186 (76.2)	32 (13.2)	18 (7.4)	4 (1.6)	4 (1.6)
Worried about teeth, gums, or dentures	99 (40.6)	45 (18.4)	70 (28.7)	20 (8.2)	10 (4.1)
Self-conscious of teeth, gums, or dentures	145 (59.4)	36 (14.8)	44 (18.0)	12 (4.9)	7 (2.9)
Pleased with the look of teeth	19 (7.8)	37 (15.1)	49 (20.1)	51 (20.9)	88 (36.1)

RESULTS

A total of 244 questionnaires were distributed and completed. The mean age of the respondents was 56.2 years (standard deviation [SD], 8.1 years; Table 1). Approximately 30% (n = 72) of patients were aged ≥60 years, and approximately half were 45–59 years old. There was an equal distribution of males and females. The majority (93%) had at least secondary education, and over one-third (36.3%) had a household monthly income of less than RM2000. With regard to comorbidities, 39.8% of patients had diabetes mellitus, 61.9% had hypertension, and 46.7% had hypercholesterolemia. Overall, approximately 52% of patients had been diagnosed with one NCD, whereas the rest had more than two NCDs, and 62.3% were not wearing any dental prosthesis. Most respondents who wore a dental prosthesis were wearing dentures (74.5%). Responses to the GOHAI items tended to be "never," "sometimes," or "always," with few using in-between responses (Table 2). In terms of prevalence of impacts (scored at least "seldom"), most patients (66.0%) experienced difficulty in biting some food, 59.4% worried about their teeth, gums, or dental prosthesis, and 57.8% experienced discomfort when eating.

For tooth replacement preferences, dental implants were the most preferred replacement option (38.9%) when respondents were unaware of the treatment cost (Table 3). When informed of the cost, the most preferred option was dentures (49.2%). On average, respondents were willing to pay up to RM787.80 (SD, RM600.50), RM1366.70 (SD, RM730.30), and RM2833.30 (SD, RM1505.10) for dentures, bridges, and dental implants, respectively (Table 4). The minimum they were willing to pay was RM50, RM100, and RM100, respectively, and the maximum was RM5000, RM5000, and RM10,000, respectively. A total of five, eight, and 21 respondents were not willing to pay for dentures, bridges, and dental implants, respectively, whereas only three respondents were not willing to pay for any dental prosthesis.

Table 3. Preferences for tooth replacement

	First preference *n* (%)	Second preference *n* (%)	Third preference *n* (%)
When unaware of the cost			
Bridge	75 (30.7)	128 (52.5)	41 (16.8)
Denture	74 (30.4)	55 (22.5)	115 (47.1)
Implant	95 (38.9)	61 (25.0)	88 (36.1)
When informed of the cost			
Bridge	78 (32.0)	140 (57.4)	23 (9.4)
Denture	120 (49.2)	56 (23.0)	65 (26.6)
Implant	43 (17.7)	45 (18.4)	153 (62.7)

Table 4. Willingness to pay

	Amount willing to pay (RM)			
Type of prosthesis	**Mean**	**SD**	**Min***	**Max**
Denture	787.80	600.50	50.00	5000.00
Bridge	1366.70	730.30	1000.00	5000.00
Implant	2833.30	1505.10	100.00	10,000.00

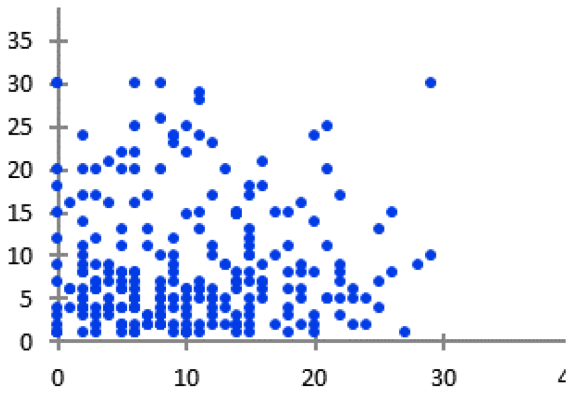
*A total of five, eight, and 21 patients were not willing to pay for dentures, bridges, and implants, respectively, and three were not willing to pay for any prosthesis.

The number of missing teeth ranged from 1 to 28 (mean 8.3; SD, 7.3; Table 5); almost two-thirds (63.5%) had at least 20 natural teeth. The mean GOHAI score was 16.3 (SD, 4.8) of a maximum possible score of 48.

The GOHAI scores were not significantly correlated with the number of missing teeth (Pearson's correlation, $r = -0.01$, $P = 0.868$; Fig. 1).

Table 5. Number of teeth missing and present

Number of teeth	Mean	SD	Min	Max
Missing				
All	8.3	7.3	1	28
Anterior	2.1	3.2	0	12
Posterior	6.1	4.9	0	20
Present				
All	19.2	7.1	0	27



Pearson's correlation, $r = -0.01$, $P = 0.868$

Figure 1. Correlation between GOHAI scores and number of missing teeth.

DISCUSSION

We investigated the impact of tooth loss and tooth replacement preferences among patients with NCDs. Tooth loss is prevalent among adults, which necessitates a substantial use of resources to provide prosthodontic treatment. Clinician-led oral healthcare is costly and poses a burden on health resources as the proportion of older dentate adults continues to increase with improved living and healthcare standards. The risk of tooth loss increases with age, as does the risk of NCDs such as diabetes and hypertension. We investigated whether patients faced with the burden of NCDs would also report significant impacts arising from tooth loss.

Several patients with tooth loss do not choose tooth replacement, as evident in the last national oral health survey.[2] The same trend was observed in a study affirming that normative needs rarely translate into patient demand in seeking treatment.[16] A higher demand for prosthodontic treatment may be expected when society no longer accepts missing teeth as a norm, and the Malaysians represented in this study are not yet at this level.[17] Oral health-related quality of life (OHQoL) is recommended so that clinicians may better understand the consequences of oral disease and tooth loss and provide a more holistic plan to manage these patients.[18] The use of such an assessment has also been advocated as a means of focusing treatment resources provided through public-funded health services.[19] With limited resources for example, prosthodontic treatment could be prioritized for patients who are poorly affected by their tooth loss.

From our results, the mean GOHAI score was 16.3 of a possible maximum 48, which is not very high. Higher proportions of respondents answered "never" or "sometimes" to the negative response questions as opposed to "often" and "always," suggesting that the impacts were tolerable. These responses were consistent regardless of the number of missing teeth. Our findings are in agreement with previous findings reporting no statistically important relationship between impact of tooth loss and presence of systemic diseases.[20] However, stronger inverse correlations between GOHAI scores and number of teeth present have been reported, although this was not the case in our study.[21] Most of our respondents answered negatively to the "physical" dimension, followed by the "worried" and "social" dimensions. This is in line with previous studies suggesting GOHAI score association for the physical dimension but not for the social and worried dimensions between edentulous and dentate patients.[22] Conversely, Ekanayake and Perera found only a weak association between tooth loss and other clinical parameters, on the one hand, and oral impacts, on the other hand, in a population of older adults in Sri Lanka.[23] It is argued that a lower prevalence of OHQoL impacts among older age groups may be explained by the cultural attitude of accepting tooth loss as a normal consequence of aging, thus also accepting impacts associated with tooth loss as normal. In our study, approximately three-fourths of participants were at least 45 years old. Also, our patients could be more concerned about other aspects of their health conditions that were related to their NCDs rather than their missing teeth.

It was interesting to note that 62.3% of all our participants were not wearing any form of dental prosthesis regardless of type (anterior or posterior) and number of missing teeth. This could be explained by the lack of perceived need, not experiencing significant impacts of tooth loss, not satisfied with a present denture, or acceptance of tooth loss and its consequences as a natural course of aging, which warrants further investigation. An in-depth qualitative study could be embarked on to help shed light on this finding as the scope of not wearing prostheses to replace missing teeth was not covered in our study.

In several cases, the cost of treatment is considered a major determinant in seeking dental treatment. Dental implants were the most preferred replacement option when the respondents were unaware of treatment cost; however, when informed of the cost, the most

preferred option was dentures. This suggests that the cost of treatment is a crucial factor in choosing a dental prosthesis, especially for the implant treatment option, and therefore our findings are consistent with those reported by Tepper et al.[24] Patients' willingness to pay for an implant is much lower than the market price in the private sector, payment for a bridge is slightly lower, and that for dentures is in the market price range. As reported by Kohli et al., [25] dental implants were expensive and unaffordable by Malaysian patients.[25] Interestingly, very few respondents indicated that they were not willing to pay any fees for any of the prostheses. This is in contrast with the common perception that members of the public who have access to highly subsidized healthcare would not be willing to pay for their dental treatment. Currently in Malaysia, dental care in the Ministry of Health is highly subsidized and is preferred by two-thirds of the population.[2]

The presence of functional dentition of at least 20 natural teeth is an oral health goal of the World Health Organization, suggesting that when a person has at least 20 teeth, he or she would still be able to enjoy tooth-related quality of life.[26] In our study, GOHAI scores were not related to number of missing teeth. This could be explained by the fact that the majority of respondents (63.5%) still had at least 20 natural teeth, and up to 62.3% did not wear any dental prosthesis. This finding was in line with that of Ekanayake and Perera,[27] which showed that quality of life was more favorable in individuals with <20 teeth missing. Furthermore, Silva et al.[28] showed that the majority of people with <20 teeth assessed their chewing capacity negatively within the Brazilian context.

This study was limited by the convenience sampling method used. Despite this, the findings are useful in providing insight on impact of tooth loss and tooth replacement preferences among older adults with NCDs. The study did not investigate reasons why participants do not use dental prostheses despite having missing teeth, although it could be implied that they do not perceive the need for a prosthesis. A qualitative study may be undertaken to understand what Malaysians expect from a dental prosthesis or whether they expect any treatment at all after dental extraction. It would be interesting to study groups of people with severe tooth loss compared with those with at least 20 standing teeth and whether these perceptions differ when missing teeth are mostly anterior or posterior. Gaps remain as to whether one should continue to provide prosthodontic treatment for partially dentate patients if their missing teeth do not significantly affect their lives.

CONCLUSION

Tooth loss and use of dental prostheses had some impact on the quality of life of participants in this study, but the impact was not high. This could be because the majority of respondents still had at least 20 natural teeth, and many did not wear any dental prosthesis. Implants were the most preferred option, but this changed to dentures when respondents were informed about the treatment cost. Their willingness to pay for each treatment was lower than the market rates. As such, there should be a financing scheme to ease the burden for those truly in need.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in relation to this study.

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