

Prognoses of new complete dentures from the patient's denture assessment of existing dentures

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Abstract

Objectives The aim was to determine prognostic factors affecting frequent post-delivery adjustments of new complete dentures using patients' assessments of existing complete dentures.

Materials and methods A total of 125 edentulous participants (56 men, 69 women; mean age, 76.4 years) who required new complete dentures evaluated existing dentures using the patient's denture assessment (PDA), a questionnaire regarding the self-assessment of dentures composed of 22 question items and containing six subscales: "function," "lower denture," "upper denture," "expectation," "esthetics and speech," and "importance." Moreover, the numbers of post-delivery adjustments of new dentures were recorded. A multiple logistic regression analysis was performed to identify significant factors for frequent adjustments of new dentures with five subscales of the PDA (excluding "importance"), level of mandibular ridge resorption, and age as independent variables.

Results The analysis showed that "function," "esthetics and speech," and level of mandibular ridge resorption were significant variables for a frequent number of post-delivery adjustments of new complete dentures.

Conclusions The results suggested that patients' assessments of existing dentures using the PDA might allow a prediction of

prognosis for complete denture treatments. Additionally, low "function" scores and high "esthetics and speech" scores for existing dentures and high levels of mandibular ridge resorption were significant prognostic factors affecting frequent post-delivery adjustments of new complete dentures.

Clinical relevance It may be difficult for edentulous persons to adapt to new complete dentures, especially those who have complaints about mastication and swallowing with existing dentures and poor mandibular ridges, but are satisfied with esthetics and speech.

Keywords Edentulous · Complete denture · Questionnaire · Denture adjustment

Introduction

In recent years, the prevalence of edentulism among elders aged 65 years or older is falling in much of the industrialized world, including Japan, although the prevalence remains high in some countries [1]. Complete denture treatment is still the first-choice standard for tooth replacement in elderly edentulous individuals despite the well-established treatment modality and confirmation of long-term prognosis of implant overdentures [2].

Prognoses for complete denture treatments rely on estimations of patients' adaptabilities to new dentures, which is a distinction between a patient who possesses no or slow adaptability and a patient who possesses rapid adaptability [3, 4]. Previous studies reported that most edentulous individuals are satisfied with their complete dentures; however, there are edentulous patients who cannot adapt to their dentures and require prolonged treatment [5, 6]. They typically have a long list of complaints about their dentures and a collection of discarded dentures from previous treatments [4]. Difficulties

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in adaptation to dentures are associated with several different denture-related, patient-related, and oral factors [7], but the specific factors are not yet entirely clear.

The numbers of post-delivery adjustments of new dentures depend on the patient's adaptability to new dentures, because patients visit dentists until they reach the stage of incorporating their new dentures [8]. Gaspar et al. reported that there was no significant correlation between previous experience with complete dentures for chewing, esthetics, phonetics, and comfort of use on a visual analog scale (VAS) and the number of post-delivery adjustments [9]. On the other hand, Kotkin et al. investigated prognostic factors related to the number of post-delivery adjustments as an indicator of the patient's adaptability to new dentures with a questionnaire of denture complaints that represented the patient's evaluation of pain, appearance, mastication, speech, retention, denture breakage, and food accumulation under the dentures [4]. The stepwise logistic regression analysis revealed that complaints about speech ascribed to maxillary existing dentures and complaints about mastication and appearance ascribed to mandibular existing dentures required significantly prolonged post-delivery adjustment periods.

Several instruments were used to predict a patient's adaptability to new complete dentures. Questionnaires are useful instruments as adjuncts to prognosis [4]. Aside from the questionnaire of denture complaints used by Kotkin et al., Batt et al. used a behavioral rating scale for edentulous individuals that rates 35 aspects of everyday behavior on a three-item scale [3]. Similarly, a questionnaire was developed for the self-assessment of dentures, referred to as the Patient's Denture Assessment (PDA) [10, 11]. The PDA comprises 22 question items covering the following six subscales: "function," "lower denture," "upper denture," "expectation," "esthetics and speech," and "importance;" its validity and reliability have been confirmed. If an association between PDA scores before treatment and outcomes after treatment such as the numbers of post-delivery new denture adjustments is revealed, the prognosis for the difficulty of treatment will be predictable from PDA scores at the pre-treatment diagnosis.

Therefore, the aim of the study was to identify prognostic factors for the number of post-delivery new denture adjustments reflecting patients' adaptabilities to new dentures using the PDA before treatment. The null hypothesis was that there was no association between the PDA score before treatment and the number of post-delivery new denture adjustments.

Materials and methods

Participants

The subjects in the study comprised 140 edentulous patients who had been edentate for a minimum of 1 year, wore upper

and lower complete dentures, and required new conventional complete dentures (61 men and 79 women; mean age, 76.4 years). Patients who had infectious diseases, orofacial motor disorders, and psychiatric disorders were excluded. Levels of mandibular ridge resorption were rated using a five-point scale. "Zero" represented the high level of mandibular ridge resorption, whereas "four" represented the low level of mandibular ridge resorption. "Four" corresponded to a mandibular ridge soon after extraction, "three" corresponded to a mandibular ridge with sufficient height and width, "two" corresponded to a mandibular ridge with sufficient height and insufficient width, "one" corresponded to a flat-type mandibular ridge, and "zero" corresponded to a caving type of mandibular ridge. Patients were recruited from the undergraduate student treatment clinic at the Tokyo Medical and Dental University Hospital Faculty of Dentistry from 2009 to 2011. At the clinic, patients could commence treatment with undergraduate students under faculty staff supervision from the date of their first visit. The students were instructed by the faculty staff one to one. Patients were informed about the nature of the study and provided written informed consent prior to enrollment. The study was approved by the institutional ethics committee of Tokyo Medical and Dental University under registry number No. 232. The technique for making complete dentures involved primary and secondary impressions, the recording of jaw relationships using occlusal rims, one or two trial insertions, and fitting the new dentures. The dentures were fabricated by undergraduate students and faculty staff. The occlusal scheme of the dentures was fully bilaterally balanced occlusion. After the replacement of complete dentures, adjustments to the dentures were made by the undergraduate students and faculty staff until a prosthodontics specialist judged that further adjustment was unnecessary. The prosthodontics specialist was just in charge of the judgment, so he did not adjust the new dentures.

Patient's denture assessment

The PDA comprises 22 question items covering the following six subscales: "function," "esthetics and speech," "lower," "expectation," "upper denture," and "importance" [11]. Table 1 shows the 22 question items of the PDA, which were translated from Japanese into English for this article. The reliability and validity of the Japanese version of the PDA have been confirmed. On the other hand, the English version of the PDA is now at the stage of assessment of the reliability and validity after the rigorous translation into English. In the questionnaire, each item was measured using a 100-mm VAS, which consisted of a horizontal 100-mm line anchored by words representing the worst situation at the extreme left of the scale and words representing the best situation at the extreme right. All participants were instructed to complete the PDA before treatment. Each score from the PDA for each participant was

Table 1 Question items in the patient's denture assessment (PDA)

Subscale	Questionnaire items
Function	Q1. How much pain do you feel?
	Q2. How easy is it to swallow foods and liquids?
	Q3. How pleasant is it to eat food?
	Q4. How tired does your jaw feel?
Esthetics and speech	Q5. How concerned are you about being stared at by others?
	Q6. How difficult is it to engage in a conversation with others?
	Q7. How concerned are you about the appearance of your mouth?
	Q8. How often do your dentures click when chewing?
Lower denture	Q9. How often are food particles stuck in your lower denture?
	Q10. How stable is your lower denture?
	Q11. How well does your lower denture fit your gum?
	Q12. How uncomfortable is your lower denture?
Expectation	Q13. Do you think your new dentures will meet your expectations?
	Q14. Do you think that there will be any problems with your new dentures?
	Q15. Do you think your new dentures will suit you?
Upper denture	Q16. How often are food particles stuck in your upper denture?
	Q17. How well does your upper denture fit your gum?
	Q18. How often does your upper denture fall off?
Importance	Q19. Do you think your dentures are a part of your body?
	Q20. How important are your dentures to you?
	Q21. How easy is it to take care of your dentures?
	Q22. Do you feel at ease when wearing your dentures?

converted to a standardized score with a mean value =0 and standard deviation =1 for each question item. Each subscale score was calculated by summing the standardized values for question items corresponding to each subscale, respectively.

Statistical analysis

The number of post-delivery new denture adjustments which referred to the number of denture adjustments by the students and faculty staff from the first adjustment visit following the new denture placement to the completion of adjustments was

dichotomized as 0 for values ≤ 6 and 1 for values ≥ 7 . A multiple logistic regression analysis was performed to identify variables associated with the number of post-delivery new denture adjustments. The independent variables in the multiple logistic regression analysis were five subscales of the PDA (except for “importance”), level of mandibular ridge resorption, and age. Odds ratios (ORs), 95 % confidence intervals (CIs), and *P* values were estimated. *P* values <0.05 were considered statistically significant. Analyses were performed using the Japanese edition of SPSS 16.0 (SPSS Statistics 16.0, SPSS Inc., an IBM Company, Chicago, IL, USA).

Results

Six participants dropped out because of sickness and refusal to participate in the study. Nine participants did not complete the PDA. The data from a total of 125 patients (56 men and 69 women; mean age, 76.4 years) were used for the analysis. Table 2 shows the durations of edentulousness, numbers of previous complete denture, period of existing denture use, and level of mandibular ridge resorption. Table 3 shows the mean value and standard deviation (SD) of the PDA before treatment. The mean number of post-delivery denture adjustments was 5.6. Eighty-four participants required ≤ 6 post-delivery denture adjustments, whereas 41 participants required ≥ 7 post-delivery denture adjustments.

Table 4 shows the results of the logistic regression analysis. “Lower denture”, “expectation” and “upper denture” subscales of the PDA and age were not significantly associated with frequent post-delivery new denture adjustments whereas low “function” subscale scores for existing dentures (OR = 0.72; 95 % CI = 0.60–0.86), and high “esthetics and speech” subscale scores for existing dentures (OR = 1.24; 95 % CI = 1.03–1.60) were significantly associated with frequent post-delivery new denture adjustments. A high level of mandibular ridge resorption (OR = 1.57; 95 % CI = 1.00–2.46) was also associated with frequent post-delivery new denture adjustments.

Discussion

The results of the logistic regression analysis demonstrated that lower “function” subscale scores and higher “esthetics and speech” subscale scores for existing dentures exerted significant effects on frequent post-delivery adjustments of new dentures. The “function” subscale mainly comprises questions related to mastication, pain, and fatigue. On the other hand, the “esthetics and speech” subscale comprises questions related to appearance when wearing dentures and speech. Thus, questions from the “function” and “esthetics and speech” subscales cover questions related to the three major purposes of

Table 2 Duration of edentulousness, number of sets of previous complete dentures, period of existing denture, and level of mandibular ridge resorption (*N* = 125)

Variable	Upper denture	Lower denture
Duration of edentulousness		
<1 year	3	–
1 year ≤3 years	7	12
3 years ≤ 5 years	10	9
5 years ≤ 10 years	20	20
≥10 years	85	84
Number of previous complete denture		
0	4	1
1–3	98	99
4–6	17	19
≥7	6	6
Period of existing denture use		
<5 years	98	84
5 years ≤ 10 years	14	29
≥10 years	13	12
Level of mandibular ridge resorption		
4 (soon after extraction)	4	2
3 (sufficient height and width)	91	34
2 (sufficient height and insufficient width)	22	35
1 (flat)	7	41
0 (caving)	1	13

Table 3 Mean value and standard deviation (SD) of patient’s denture assessment (PDA) scores for before treatment (*N* = 125)

Subscale	Items	Means ± SDs
Function	Q1	72 ± 33
	Q2	81 ± 23
	Q3	74 ± 27
	Q4	74 ± 31
Esthetics and speech	Q5	38 ± 35
	Q6	45 ± 34
	Q7	44 ± 35
	Q8	55 ± 83
Lower denture	Q9	57 ± 37
	Q10	70 ± 32
	Q12	59 ± 38
Expectation	Q13	37 ± 39
	Q14	39 ± 42
	Q15	70 ± 34
Upper denture	Q16	70 ± 32
	Q17	58 ± 38
	Q18	68 ± 91
Importance	Q19	88 ± 23
	Q20	94 ± 15
	Q21	74 ± 27
	Q22	79 ± 27

SD standard deviation

complete denture treatment: the recovery of mastication, speech, and esthetics. The participants in this study were those who requested new dentures with some complaints about their existing dentures. The study results show that those with higher speech and esthetics satisfaction levels, but greater mastication complaints ascribed to their existing dentures, demonstrated greater difficulty adapting to new dentures, which suggested that in the recovery of mastication, speech, and esthetics, it might be most difficult to recover mastication. In another study, phonetic complaints ascribed to maxillary existing dentures exerted a significant effect on more frequent post-delivery adjustments [4], which contradicted the results of our study. Although the need to cover the palate and the thickness of the cover might cause a prolonged adaptation

Table 4 The results of the multiple logistic regression analysis for the number of post-delivery new denture adjustments (*N* = 125)

Variable	Coefficient	SE	OR	95 % CI	P
Function	−0.330	0.089	0.72	0.60–0.86	0.000
Esthetics and speech	0.250	0.112	1.24	1.03–1.60	0.026
Lower denture	0.068	0.088	1.07	0.90–1.27	0.444
Expectation	−0.068	0.088	0.93	0.79–1.11	0.440
Upper denture	−0.145	0.104	0.86	0.71–1.10	0.161
Level of ridge resorption	0.453	0.229	1.57	1.00–2.46	0.048
Age	−0.026	0.027	0.98	0.92–1.03	0.346

SE standard error, OR odds ratio, CI confidence interval

period, it is considered that differences in language and pronunciation exerted varied influences on the number of post-delivery adjustments.

High levels of mandibular ridge resorption contributed to significant effects on frequent post-delivery adjustments of new dentures in this study. Essentially, the number of mandibular mucosal injuries was significantly higher than that of maxillary mucosal injuries, and the number of adjustment visits was higher for mandibular dentures [12]. In addition, the adaptation of a removable prosthesis on atrophic mucosal and osseous tissues was associated with a greater number of follow-up visits than in cases of well-preserved tissue [8]. For these reasons, the level of mandibular ridge resorption became a significant prognostic indicator of the number of post-delivery adjustments.

On the other hand, the “lower denture” subscale was not a prognostic indicator. The “lower denture” subscale comprises questions related to the retention and stability of lower dentures. Atrophic mucosal and osseous tissues are most likely related to retention loss and the inferior stability of mandibular dentures [13]. However, mandibular denture looseness was not a significant prognostic indicator of the number of post-delivery adjustments of new dentures in another study [4], in accordance with the results of this study. Because edentulous individuals who wear complete dentures might be more aware of their handicap and better at functioning with dentures through a long prosthetic history that they transitioned to their current situation through removable partial denture status, they might have already become habituated to mandibular denture instability and looseness [14].

In this study, age was included as an independent variable in the logistic regression analysis, because a previous logistic regression model revealed that advanced age was a significant prognostic indicator of a decreased ability to adapt to dentures. However, in this study, age was not a prognostic indicator, supporting the results of another study that the age of the patient had no relationship to a decreased ability to adapt to dentures [8]. On the other hand, previous studies implied a relationship between sex and adaptability to dentures; men were reported to adapt more rapidly to new dentures than women [8]. Moreover, more women complained about the appearance of their dentures [15, 16], whereas more men had objections regarding mastication [16]. Therefore, this study reduced the difference between the numbers of women and men.

The PDA comprises six subscales: “function,” “esthetics and speech,” “lower denture,” “expectation,” “upper denture,” and “importance.” However, “importance” was not included in the logistic regression analysis as an explanatory variable because of a ceiling effect [11]. Moreover, because each question item in the PDA is not assigned a weighted score, all scores in this study were converted to standardized scores to eliminate

differences in levels of contributions to the overall score between items.

Post-delivery adjustments of new dentures are part of an important clinical phase in complete denture treatment [4]. It was reported that the numbers of maxillary denture adjustments were up to three, whereas the numbers of mandibular denture adjustments ranged from three to six [12, 17]. In addition, the most common number of post-delivery adjustments for Japanese edentulous individuals was five [18], which was the cut-off value used to distinguish participants who possessed no or slow adaptability to new dentures from participants who possessed rapid adaptability to new dentures in another study [4]. In this study, the mean number of post-delivery adjustments was 5.6, which was the reason that six adjustments was used as the cut-off value for the number of post-delivery denture adjustments as a dependent variable in the logistic regression analysis. The number of post-delivery new denture adjustments was defined as the number of denture adjustments by the students and faculty staff in this study. The patients were received complete denture treatment by chiefly the faculty staff. The treatment time for each treatment in the student treatment clinic was longer than usual because the treatment time included the time for the faculty staff to instruct the students. However, the quality of denture adjustments in the clinic was same as in the faculty staff clinic. Therefore, it seems likely that treatment in the student clinic had insignificant effect on the number of new denture adjustments.

The dentures were fabricated by students under faculty staff supervision, not by dental technicians in the present study. Admittedly, the technical quality of dentures differs between students and dental technicians, but the faculty staff checked both the students’ clinical and technical work at each stage. Moreover, previous studies revealed that the acceptance of dentures is usually unrelated to the technical quality of the prosthesis [16]. Thus, the denture itself might not influence the number of post-delivery denture adjustments.

An association between the personality of a patient and adaptability to dentures was reported in a previous study [19]. Patients who reported psychological stress using a test for personality analysis in relation to stress generally exhibited lower levels of satisfaction with their dentures with regard to esthetics, speaking ability, and masticatory function than those who were stress-free. Because of the limited sample size in this study, personalities were not included in the analysis as independent variables. Thus, in a further study, a larger sample size will be necessary to investigate associations between more factors influencing adaptability to dentures and the number of post-delivery new denture adjustments.

Similarly, there are additional possible factors that might determine the prognosis of complete denture treatment: previous denture experience, the period of existing denture use, numbers of previous complete dentures, and duration of

edentulousness. The patients with two complete dentures have longer prosthetic history and they are more experienced in the process of adaptation than removable partial denture wearers, which shortens the time necessary for adaptation to complete denture wearers [8]. In addition, there was a significant association between the period of existing denture use and the number of post-delivery adjustments of new removable partial dentures [20] whereas there was no significant association between the number of previous partial dentures and the number of post-delivery adjustments [21]. On the other hand, there might be an indirect association between the duration of edentulousness and the number of post-delivery adjustments of new complete dentures because the duration of edentulousness had a significantly higher rate of resorption which contributed to significant effects on frequent post-delivery adjustments of new dentures in this study in patients being edentulous less than 1 year than in patients being edentulous for 1–10 years or for over 10 years [22]. Thus, in the study, the patients who had been edentate for less than 1 year were excluded. There is no research that investigated the association between those factors and the number of post-delivery adjustments of new complete dentures. Therefore, we should investigate associations with larger sample size.

It is highly likely that the data in the study were obtained from not only those who have non-symptomatic psychiatric disorders but also those who have somatoform disorders and relevant somatoform disorders because the patients were determined not through an examination by a specialized doctor of psychiatry, but only through medical interview by the trained dentists that belonged to the prosthetic clinic. It is thus possible that the results of the study were less accurate. Implementation of the PDA might require screening for somatoform to obtain more accurate data.

Many researchers have indicated that the success of complete denture treatment depends on the psychological counseling of the patients. Patients need to be helped to understand that compromises may be necessary. Psychological counseling of patients before treatment could help patients to adapt to changes in the features of their new complete dentures and dispel unrealistic expectations and misconceptions, thus leading to a shortened adaptation period for new dentures [15, 16, 23]. Because all participants in this study were recruited in a university hospital setting, the participants' personalities and mucosal and osseous tissue conditions might be different from those of the general population. However, following the results of the study, it is suggested that an assessment of existing dentures with the PDA enables the recognition of patients who require a prolonged period to adapt to new dentures before treatment. Thus, doctors are able to prepare for a difficult denture treatment among these patients and to counsel them adequately before treatment to avoid

dissatisfaction with their new dentures and distrust towards their dentists.

Conclusions

The results suggested that a patient's assessment of existing dentures using the PDA at pre-treatment might allow for a prognostic prediction for complete denture treatment. In addition, low "function" subscale scores and high "esthetics and speech" subscale scores for existing dentures and high levels of mandibular ridge resorption had significant associations with more frequent post-delivery adjustments of new complete dentures.

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no competing interests.

Ethical approval The study was approved by the institutional ethics committee of Tokyo Medical and Dental University under registry number No. 232.

Informed consent The patients were informed about the nature of the study and provided written informed consent prior to enrollment.

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