Original article

Structural equation modeling for factors influencing patients’ willingness to replace removable dentures

Yuka Abe1), Takashi Matsumoto1), Hiroyuki Watanabe1), Deepesh K. Gupta1,2), and Kazuyoshi Baba1)

1) Department of Prosthodontics, School of Dentistry, Showa University, Tokyo, Japan
2) Department of Prosthodontics, Government Dental College Raipur, Chhattisgarh, India

Abstract

Purpose: To investigate the factors influencing patients’ willingness to replace removable dentures using structural equation modeling (SEM).

Methods: A total of 153 patients who sought consultations for removable dentures self-evaluated denture quality using a visual analog scale (VAS); health-related quality of life using the 36-item Short-Form Health Survey; and oral health-related quality of life using the Oral Health Impact Profile. Dental clinicians evaluated denture quality using a VAS and by assessing the presence of defects. After being informed of various treatments, patients were asked whether they would prefer denture replacement. SEM was applied to analyze the relationships and interactive effects among the variables.

Results: The final model showed high goodness-of-fit indices (chi-square/degree of freedom = 1.009, comparative fit index = 1.000, Tucker-Lewis index = 0.999, standardized root mean square residual = 0.421, and root mean square error of approximation = 0.008). SEM demonstrated that two latent constructs indirectly predicted patients’ willingness to replace dentures; the standardized total effects of good oral health and poor denture quality were −0.154 and 0.503, respectively.

Conclusion: These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Keywords: clinical decision-making, oral health-related quality of life, patient preference, patient-reported outcomes, removable dental prostheses, structural equation modeling

Introduction

The demand for removable dentures in industrialized countries has been increasing because of the rapid growth of the elderly population [1]. There is an increasing need to perform multidimensional assessments including overall patient health and patient preferences in the clinical decision-making process. In dentistry, the influence of oral disorders and interventions on patient-perceived oral health status, which is evaluated by a comprehensive patient-reported outcome (PRO), oral health-related quality of life (OHRQoL), is now regarded as an important component of oral health and clinical decision-making [2,3].

Previous studies have indicated that poor denture quality, as evaluated by clinicians, was associated with significant impairments in OHRQoL. SEM, a method for analyzing the relationships and interactive effects among potential denture-related factors by using SEM analysis, has been applied to analyze the relationships and interactive effects among potential denture-related factors by using SEM analysis. These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Purpose: To investigate the factors influencing patients’ willingness to replace removable dentures using SEM.

Methods: A total of 153 patients who sought consultations for removable dentures self-evaluated denture quality using a visual analog scale (VAS); health-related quality of life using the 36-item Short-Form Health Survey; and oral health-related quality of life using the Oral Health Impact Profile. Dental clinicians evaluated denture quality using a VAS and by assessing the presence of defects. After being informed of various treatments, patients were asked whether they would prefer denture replacement. SEM was applied to analyze the relationships and interactive effects among the variables.

Results: The final model showed high goodness-of-fit indices (chi-square/degree of freedom = 1.009, comparative fit index = 1.000, Tucker-Lewis index = 0.999, standardized root mean square residual = 0.421, and root mean square error of approximation = 0.008). SEM demonstrated that two latent constructs indirectly predicted patients’ willingness to replace dentures; the standardized total effects of good oral health and poor denture quality were −0.154 and 0.503, respectively.

Conclusion: These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Keywords: clinical decision-making, oral health-related quality of life, patient preference, patient-reported outcomes, removable dental prostheses, structural equation modeling

Introduction

The demand for removable dentures in industrialized countries has been increasing because of the rapid growth of the elderly population [1]. There is an increasing need to perform multidimensional assessments including overall patient health and patient preferences in the clinical decision-making process. In dentistry, the influence of oral disorders and interventions on patient-perceived oral health status, which is evaluated by a comprehensive patient-reported outcome (PRO), oral health-related quality of life (OHRQoL), is now regarded as an important component of oral health and clinical decision-making [2,3].

Previous studies have indicated that poor denture quality, as evaluated by clinicians, was associated with significant impairments in OHRQoL. SEM, a method for analyzing the relationships and interactive effects among potential denture-related factors by using SEM analysis, has been applied to analyze the relationships and interactive effects among potential denture-related factors by using SEM analysis. These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Purpose: To investigate the factors influencing patients’ willingness to replace removable dentures using SEM.

Methods: A total of 153 patients who sought consultations for removable dentures self-evaluated denture quality using a visual analog scale (VAS); health-related quality of life using the 36-item Short-Form Health Survey; and oral health-related quality of life using the Oral Health Impact Profile. Dental clinicians evaluated denture quality using a VAS and by assessing the presence of defects. After being informed of various treatments, patients were asked whether they would prefer denture replacement. SEM was applied to analyze the relationships and interactive effects among the variables.

Results: The final model showed high goodness-of-fit indices (chi-square/degree of freedom = 1.009, comparative fit index = 1.000, Tucker-Lewis index = 0.999, standardized root mean square residual = 0.421, and root mean square error of approximation = 0.008). SEM demonstrated that two latent constructs indirectly predicted patients’ willingness to replace dentures; the standardized total effects of good oral health and poor denture quality were −0.154 and 0.503, respectively.

Conclusion: These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Keywords: clinical decision-making, oral health-related quality of life, patient preference, patient-reported outcomes, removable dental prostheses, structural equation modeling

Introduction

The demand for removable dentures in industrialized countries has been increasing because of the rapid growth of the elderly population [1]. There is an increasing need to perform multidimensional assessments including overall patient health and patient preferences in the clinical decision-making process. In dentistry, the influence of oral disorders and interventions on patient-perceived oral health status, which is evaluated by a comprehensive patient-reported outcome (PRO), oral health-related quality of life (OHRQoL), is now regarded as an important component of oral health and clinical decision-making [2,3].

Previous studies have indicated that poor denture quality, as evaluated by clinicians, was associated with significant impairments in OHRQoL. SEM, a method for analyzing the relationships and interactive effects among potential denture-related factors by using SEM analysis, has been applied to analyze the relationships and interactive effects among potential denture-related factors by using SEM analysis. These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Purpose: To investigate the factors influencing patients’ willingness to replace removable dentures using SEM.

Methods: A total of 153 patients who sought consultations for removable dentures self-evaluated denture quality using a visual analog scale (VAS); health-related quality of life using the 36-item Short-Form Health Survey; and oral health-related quality of life using the Oral Health Impact Profile. Dental clinicians evaluated denture quality using a VAS and by assessing the presence of defects. After being informed of various treatments, patients were asked whether they would prefer denture replacement. SEM was applied to analyze the relationships and interactive effects among the variables.

Results: The final model showed high goodness-of-fit indices (chi-square/degree of freedom = 1.009, comparative fit index = 1.000, Tucker-Lewis index = 0.999, standardized root mean square residual = 0.421, and root mean square error of approximation = 0.008). SEM demonstrated that two latent constructs indirectly predicted patients’ willingness to replace dentures; the standardized total effects of good oral health and poor denture quality were −0.154 and 0.503, respectively.

Conclusion: These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.

Keywords: clinical decision-making, oral health-related quality of life, patient preference, patient-reported outcomes, removable dental prostheses, structural equation modeling

Introduction

The demand for removable dentures in industrialized countries has been increasing because of the rapid growth of the elderly population [1]. There is an increasing need to perform multidimensional assessments including overall patient health and patient preferences in the clinical decision-making process. In dentistry, the influence of oral disorders and interventions on patient-perceived oral health status, which is evaluated by a comprehensive patient-reported outcome (PRO), oral health-related quality of life (OHRQoL), is now regarded as an important component of oral health and clinical decision-making [2,3].

Previous studies have indicated that poor denture quality, as evaluated by clinicians, was associated with significant impairments in OHRQoL. SEM, a method for analyzing the relationships and interactive effects among potential denture-related factors by using SEM analysis, has been applied to analyze the relationships and interactive effects among potential denture-related factors by using SEM analysis. These findings provide a unified understanding of the shared decision-making process for denture replacement and highlight the pretreatment assessments that play a relevant role in patient treatment preferences.
using the Japanese version of OHIP [14-16]. The OHIP is composed of 49 items assessing how frequently respondents had experienced its impact in the last month. Responses are provided on a five-point scale from 0 (never) to 4 (very often). The OHIP summary scores based on the 49 items can range from 0 to 196; a higher OHIP summary score indicates greater OHRQoL impairment.

Esthetics and stability are clinically important aspects of removable denture quality. Patient perception of esthetics and denture stability was assessed using a 100-mm visual analog scale (VAS), with the anchors 0 and 100 representing “completely dissatisfied” and “completely satisfied,” respectively. Stability was defined by the magnitude of denture movement in the mouth when forces were applied to the denture, with less movement indicating a more stable denture. Esthetics was defined as the appearance of the teeth and mouth when a denture was placed in the mouth [4]; therefore, the VAS score for esthetics reflected the appearance of the remaining teeth and fixed prostheses as well as that of the removable denture itself. For patients with two removable dentures on both jaws, the quality of each denture was assessed separately, and the lower VAS score was chosen. The average of the VAS scores for esthetics and denture stability for each patient was regarded as the patient-rated denture quality score.

Denture evaluation by clinicians
Denture quality, including esthetics and stability, was also assessed by dental clinicians using a similar approach to that used by patients. A total of 41 clinicians who had finished Japanese dental internship programs and were working at the university-based prosthodontic clinic were asked to evaluate the esthetics and stability of the removable dentures while remaining blinded to the patients’ HRQoL and OHRQoL statuses. The reliability and reproducibility of the denture quality assessments were evaluated in eight randomly sampled dental clinicians who rated 10 dentures [5]. The intraclass correlation coefficient (ICC) for inter-examiner reliability was 0.80 (95% confidence interval [CI]: 0.45-0.94), and the ICC for reproducibility with a 2-week test–retest interval was 0.93 (95% CI: 0.85-0.97). Eventually, the average of the VAS scores for esthetics and denture stability for each patient was regarded as the clinician-rated denture quality score.

The clinicians also carefully inspected the removable dentures for visual and functional defects, including problems with integrity, excessive wear of posterior teeth, presence of retainer material or tissue conditioner, stability, and retention [17].

Patients’ willingness to replace removable dentures
After an interview and oral examinations, the dental clinicians made diagnoses and explained the possible treatment options to the patients in a standard manner. These options included immediate adjustments and repairs of currently used dentures, conventional dental treatments of the remaining teeth and residual ridge, and definitive prosthodontic treatments. The definitive prosthodontic treatment options included fabrication of new removable dentures, repair or relining of currently used dentures or use of a wait-and-see approach after minor adjustments. After explaining the treatment options, patients were asked to select one of the definitive prosthodontic treatment options.

SEM analysis
An ideal model was constructed based on an a priori hypothesis, in which patients’ willingness to replace dentures was associated with denture quality and oral health conditions. The path was analyzed using IBM SPSS Amos 26.0 (IBM Corp., Armonk, NY, USA). The significance level was set at α = 0.05. The normal theory-based maximum likelihood (ML) estimation procedure assumes that the scale of the observed variables is continuous, since Likert-scaled items that realistically represent categorical data of an ordinal scale have been frequently treated as if they were continuous [Byrne BM. Structural equation modeling with AMOS. 3rd ed. Routledge, New York, NY, USA, 2016]. To determine how adequately the hypothesized model described the sample data and modified the model in this study, a χ² test was used with the following goodness-of-fit indices: minimum discrepancy (CMIN, a χ² statistic) divided by the degree of freedom (CMIN/df), comparative fit index (CFI), Tucker-Lewis index (TLI, also called the non-normed fit index), standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), and Akaike’s information criterion (AIC) [Schumacker RE, Lomax RG. A beginner’s guide to structural equation modeling. 2nd ed. Psychology Press, New York, NY, USA, 2004]. The χ² test evaluates the null hypothesis that the predicted model and observed data are equal; accordingly, a non-significant probability value (P value) indicates that the data does not significantly differ from the hypotheses represented by the model [Kline RB. Principles and practice of structural equation modeling. 4th ed. Guilford Press, New York, NY, USA, 2015]. A CMIN/df value <3 indicates an acceptable fit between a hypothetical model and the sample data. CFI and TLI represent the incremental fit; in line with the general recommendations, CFI and TLI values >0.95 indicated an adequate fit, with a model having a lower AIC being more plausible, whereas values >0.90 were still acceptable [18]. SRMR values less than 0.05 and 0.08 indicate a good and adequate model fit, respectively [18]. RMSEA values ranging from less than 0.01, 0.05, 0.08, and 0.10 are indicative of excellent, good, reasonable, and mediocre fit, respectively [19]. Some of these indices are sensitive to the sample size and overestimate the fit when the sample is small (e.g. less than 200), whereas the RMSEA and CFI are less sensitive to the sample size [18,20]. Moreover, the fit indices yield information only regarding the model’s lack of fit, and assessment of model adequacy must be based on multiple criteria with theoretical, statistical, and practical considerations [Byrne BM. Structural equation modeling with AMOS. 3rd ed. Routledge, New York, NY, USA, 2016].

To assess the statistical significances of the link and variable estimates, the critical ratio and significance level of probability were calculated. The critical ratio, which represents the parameter estimate divided by its standard error, operates as a z-statistic in testing whether the estimate is statistically different from zero. Based on a significance level of 0.05, the critical ratio needs to be > ± 1.96. Standardized regression coefficients were provided as the magnitude of relationships that represents the contribution of each independent variable to explain a dependent variable. Standardized regression coefficients greater than 0.50, 0.30, and 0.10 were interpreted as representing powerful, medium, and small effects of one variable on another, respectively. Additionally, the squared multiple correlation, which is equivalent to the r-squared value, was obtained as a proportion of the total variance explained by the model. The standardized total effects between variables were calculated by adding the standardized direct and indirect effects based on regression coefficients.

Results
Sample profile
After the consultation for prosthodontic treatment, 81 patients (52.9%) showed a willingness to replace their removable dentures, while 72 did not (Table 1). Demographic data are shown in Table 2. The proportion of edentulous patients wearing complete dentures in both jaws was 9.2%, while the corresponding proportion of partially edentulous patients was 90.8%. There were 35 patients who had removable dentures with a metal framework. The mean number of missing teeth was 15.6 ± 7.7 SD. The results of PROs and clinician-reported outcomes are displayed in Table 3. Clinical inspections revealed that 61 patients had dentures without defects (39.9%); however, 14 patients (23.0%) stated that they would prefer to replace their dentures despite the absence of defects. In contrast, 25 (27.2%) of 92 patients with denture defects did not want to replace their dentures.
Table 1: Suggested options for definitive prosthodontic treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denture replacement</td>
<td>81 (52.9)</td>
</tr>
<tr>
<td>Repair, relining, or wait-and-see approach</td>
<td>72 (47.1)</td>
</tr>
</tbody>
</table>

Table 2: Demographic data and removable denture aspects

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>41-50</td>
<td>6 (3.9)</td>
</tr>
<tr>
<td>51-60</td>
<td>24 (15.7)</td>
</tr>
<tr>
<td>61-70</td>
<td>64 (41.8)</td>
</tr>
<tr>
<td>71-80</td>
<td>7 (10.7)</td>
</tr>
<tr>
<td>81-90</td>
<td>12 (7.8)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>92 (60.1)</td>
</tr>
<tr>
<td>Male</td>
<td>61 (39.9)</td>
</tr>
<tr>
<td>Number of missing teeth</td>
<td></td>
</tr>
<tr>
<td>1-7</td>
<td>33 (21.6)</td>
</tr>
<tr>
<td>8-14</td>
<td>33 (21.6)</td>
</tr>
<tr>
<td>15-21</td>
<td>45 (29.4)</td>
</tr>
<tr>
<td>22-28</td>
<td>42 (27.5)</td>
</tr>
<tr>
<td>Duration of use of present removable dentures†</td>
<td></td>
</tr>
<tr>
<td>Less than 2 months</td>
<td>12 (7.8)</td>
</tr>
<tr>
<td>2-6 months</td>
<td>14 (9.2)</td>
</tr>
<tr>
<td>7-12 months</td>
<td>8 (5.2)</td>
</tr>
<tr>
<td>More than 12 months</td>
<td>119 (77.8)</td>
</tr>
</tbody>
</table>

Problems with removable dentures

—Intraoral examination: integrity
  Fracture of denture base 7 (4.6)
  Crack in denture base 9 (5.9)
  Hole in denture base 4 (2.6)
  Other defects in base material (e.g. discoloration, deterioration) 12 (7.8)
  Breakage of denture clasp 13 (8.5)
  Breakage of denture rest 15 (9.8)
  Breakage of metal framework 2 (1.3)
  Unesthetic anterior teeth (uncovered tooth remnant) 6 (3.9)
  Detachment or breakage of artificial tooth 9 (5.9)
  More of occlusal surface of posterior teeth missing 53 (34.6)
—Extraoral examination: excessive wear of posterior teeth
  Inappropriate occlusal anatomy of artificial teeth 43 (28.1)
  Chipping of artificial teeth 4 (2.6)
—Extraoral examination: presence of reline material or tissue conditioner
  Daily use of patient-applied denture adhesive 1 (0.7)
  Presence of temporary lining material or tissue conditioner 14 (9.2)
—Intraoral examination: stability
  Poor stability 14 (9.2)
  Poor fitting of denture base 15 (9.8)
—Intraoral examination: retention
  Poor retention 22 (14.4)

“more than 1-year use of dentures” (standardized regression coefficient = 0.168). With regard to the effects of the latent constructs on “patients’ willingness to replace dentures,” the standardized total effect of “good oral health” was −0.154 and that of “poor denture quality” was 0.503.

Discussion

In the final model, patients’ willingness to replace dentures was significantly predicted by the three variables measured in this study, which together accounted for 42.0% of the patients’ willingness to replace dentures. Patients whose denture quality (esthetics and denture stability) were rated unsatisfactory by the clinicians were more likely to replace their denture. Among all the observed variables, this assessment of denture quality by clinicians had the most significant impact on patients’ willingness to replace dentures. The likelihood of denture replacement also showed a significant association with the identification of visual and functional denture defects by clinicians. Use of dentures for more than a year showed a fairly small effect on denture replacement. Notably, none of the PROs was shown to be a direct predictive factor.

The final model also identified two unobserved latent constructs, named “good oral health” and “poor denture quality.” The construct “good oral health” influenced three PROs (SF-36v2 MCS score, OHIP summary score, and patient-rated denture quality score) and the clinician-rated denture quality score. The magnitude of the association was the strongest for the OHIP summary score, followed by the patient-rated denture quality score, and moderate for the SF-36v2 MCS score and clinician-rated denture quality score. These results were not unexpected because the OHIP score is a highly reliable instrument to capture OHRQoL [21], and both HRQoL and denture quality are associated with OHRQoL [4, 7] and therefore directly associated with “good oral health.” Thus, the latent construct “good oral health” was indirectly associated with patients’ willingness to replace dentures via the clinician-rated denture quality score.

Another latent construct “poor denture quality” affected one PRO (patient-rated denture quality score) and three non-PROs (clinician-rated denture quality score, presence of denture defects, and duration of denture use). This finding was reasonable since all of these measures evaluated denture quality multidimensionally. Interestingly, the magnitude of the relationship of the PRO (patient-rated denture quality score) with this latent construct was weaker than that of the three non-PROs. Furthermore, the effect of this PRO on the patients’ willingness to replace dentures was not significant, while that of the other three non-PROs was significant in the model. Moreover, the three non-PROs showed weak correlations; Spearman’s rank correlation coefficient was ρ ≤ 0.385 (ρ < 0.001, clinician-rated denture quality score vs. presence of denture defects), ρ ≤ 0.301 (ρ < 0.001, clinician-rated denture quality score vs. more than 1-year use of dentures), and ρ = 0.335 (P < 0.001, presence of denture defects vs. more than 1-year use of dentures), indicating that these three variables expressed slightly different dimensions.

Within the final model, while 42.0% of the patients’ willingness to replace dentures was explained by the observed variables, the remaining 58.0% was influenced by unknown factors that were not associated with the measurement items in this study. Patient treatment preferences have been reported to be influenced by various factors. A clinical study on 136 edentulous patients in Canada showed that lower levels of satisfaction with the original dentures using a 100-mm VAS and higher levels of education were significantly associated with treatment preferences for implant overdentures over conventional complete dentures when patients were given a free choice prior to a clinical trial [22]. A cross-sectional clinical study of 131 edentulous patients in Brazil reported that education level, income, and OHRQoL impairment in the oral pain and dysfunction domain of the OHIP in edentulous adults were potentially predictive of patient treatment preferences for conventional complete dentures, 2-implant-retained overdentures, and 4-implant fixed prostheses [23]. Clinical studies reported that patients might be concerned about psychosocial benefits, functional performance, esthetics, technical and financial concerns, post-insertion
complaints, removability, treatment duration, and longevity when choosing a prosthodontic treatment [24,25]. However, the present study did not include these sociopsychological factors, which may have influenced patients’ treatment preferences.

In addition to these factors, patient–clinician relationships, clinicians’ preferences, and their explanations may influence patients’ treatment choices [26]. In this study, 41 clinicians who were working for a university-based prosthodontic clinic after completing a dental internship program participated and provided the patients with treatment options. The direct association between patients’ willingness to replace dentures and the clinician-reported outcomes may represent the patients’ tendency to afford more importance to the clinician’s opinion than their own. Thus, deficiencies in individual clinicians’ knowledge and communication skills and variabilities in patients’ comprehension abilities can cause inadequate communication to support patients in making informed decisions [27]. It has been reported that the clinician’s judgments and decisions could be guided not only by the evidence-based knowledge but also by personal practice experiences [28]. In this study, the participating clinicians had clinical experience ranging from 2 to 20 years.

Since the identified factors accounted for only 42.0% of the patients’ willingness to replace dentures, other factors that might have influenced the patient–clinician relationship, such as the clinician’s professional clinical experience and patients’ socio-psychological status, should be investigated in a future study to strengthen this final model.

According to the literature, there is no standard method available to assess the quality of removable partial dentures. The clinicians in the current study evaluated the denture quality by the number of defects [17] and two attributes of denture quality, namely stability and esthetics. These were

Table 4 Parameter estimates of the model

<table>
<thead>
<tr>
<th>Components</th>
<th>Standardized regression coefficient</th>
<th>Critical ratio</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36v2 MCS score</td>
<td>0.465</td>
<td>-4.853</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>↑ Good oral health</td>
<td>-0.919</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient-rated denture quality score</td>
<td>0.684</td>
<td>5.259</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>↑ Good oral health</td>
<td>-0.267</td>
<td>-2.906</td>
<td>0.004</td>
</tr>
<tr>
<td>Clinician-rated denture quality score</td>
<td>0.393</td>
<td>4.061</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>↑ Good oral health</td>
<td>-0.568</td>
<td>-4.058</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Presence of denture defects</td>
<td>0.692</td>
<td>3.938</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>More than 1-year use of dentures</td>
<td>0.501</td>
<td>n/a †</td>
<td>n/a †</td>
</tr>
<tr>
<td>Patients’ willingness to replace dentures</td>
<td>-0.391</td>
<td>-5.727</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>↑ Clinician-rated denture quality score</td>
<td>0.285</td>
<td>4.085</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>↑ Presence of denture defects</td>
<td>0.168</td>
<td>2.509</td>
<td>0.012</td>
</tr>
</tbody>
</table>

Variance of latent construct

| Good oral health | 2.746 | 0.006 |
| Poor denture quality | 2.564 | 0.010 |

SF-36v2, 36-item Short-Form Health Survey version 2; MCS, mental component summary; OHIP, Oral Health Impact Profile; n/a, not applicable. †The value could not be calculated because the regression weight required a fixed implementation to “1” prior to the analysis.
selected because the authors judged them to be the most representative of the denture quality based on clinical experience [4,5]. The development of a standardized method to evaluate denture quality in a more comprehensive manner may improve the predictability of patient decisions.

Another limitation of this study was that the number of cases involved in the SEM analysis was relatively small [29]. A larger number of cases would allow the assessment of more variables, as mentioned above, and improve the prediction accuracy of the model. Moreover, the data were obtained from a specific patient group, namely university-based patients seeking removable denture treatment in Japan, where the national health insurance system covers denture renewal or repair, thereby limiting the generalizability of the findings for an entire population.

To the best of the authors’ knowledge, this is the first report to use an SEM analysis to show the relationships and interactive effects among the potential factors that may influence patients’ willingness to replace removable dentures. The study results should be regarded as a benchmark to help dental clinicians understand the factors predicting patient treatment preferences and also for future studies. In conclusion, the current study successfully developed a structural equation model with high goodness-of-fit indices to characterize patients’ willingness to replace dentures in an actual clinical setting. Within the above-mentioned limitations, the model highlighted that the pretreatment clinical assessment plays a predominant role in prosthodontic treatment preferences in patients with removable dentures. The visualized model could provide dental clinicians a unified understanding of the shared decision-making process for denture replacement.

Acknowledgments
The authors received no financial support for this work.

Conflict of interest
All authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References