Treatment Outcomes Based on Patients’ Self-Reported Measures after Receiving New Clasp or Precision Attachment-Retained Removable Partial Dentures

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Keywords
Removable partial denture; clasps; precision attachment; treatment outcomes; structured questionnaires (OHIP-14, OES, CFQ).

Abstract
Purpose: To evaluate effects of a treatment taking into consideration esthetics, chewing, and oral health-related quality of life (OHRQoL) of two tooth replacement strategies for maxillary partially edentulous patients with clasp (C-RPD) and precision attachment (PA-RPD) retained removable partial dentures (RPD).

Materials and Methods: The study included 150 patients (72 men, 78 women) who received maxillary RPDs; 88 patients received clasp and 62 patients received precision attachment retained RPDs. Patients completed three questionnaires before treatment and again 3 months after treatment: the Orofacial Esthetic Scale (OES), the Oral Health Impact Profile (OHIP-14), and the Chewing Function Questionnaire (CFQ). Statistical analysis comprised descriptive statistics, paired t-test, and two-factor ANOVA.

Results: Both RPD treatments yielded better after-treatment summary scores when compared with the baseline scores (p < 0.01); however, better results were obtained in the PA-RPD group. Gender, as a single factor, did not yield significant effects; mutual interaction of retention type and gender yielded significant effects. The PA-RPD female group assessed esthetics, chewing function, and OHRQoL significantly better than males, and significantly worse than males in the C-RPD group. The covariate baseline scores yielded statistically significant effects; patients with worse pretreatment condition benefited more from both therapies.

Conclusions: Treatment outcomes were better in the PA-RPD group than the C-RPDs. Women showed greater concern for the treatment outcomes; their rates were significantly better than in male patients in the PA-RPD group; however, when their satisfaction was lower, their rates were significantly worse than in male patients (in the C-RPD group).
base RPDs provide the highest therapeutic improvements of OHRQoL when compared to acrylic RPDs or complete dentures (CDs). However, previous studies did not assess differences between C-RPDs and PA-RPDs.

The impact of oral disorders and interventions on individually perceived oral health outcomes have been increasingly recognized as an important health component. Except for the globally used OHIP questionnaire, which measures OHRQoL,16,17 two new questionnaires have been developed recently. One of them, the Orofacial Esthetic Scale (OES),18,19 has been used for patient evaluation of orofacial esthetics. Another, the Chewing Function Questionnaire (CFQ),20 has been used for patient evaluation of a chewing function.

The aim of this study was to evaluate the treatment effects considering orofacial esthetics, chewing function, and OHRQoL of two conventional tooth replacement strategies for maxillary partially edentulous patients: clasp and precision attachment retained RPDs, as well as to assess possible gender differences.

Materials and methods

Patients

A cohort of 150 patients of older age (72 men and 78 women, age range from 61 to 84 years) who received maxillary RPDs was chosen from patients seeking treatment at the Department of Prosthodontics, School of Dental Medicine, University of Zagreb, between January 2013 and October 2014. After clinical examinations, panoramic radiographic evaluations, and analyses of mounted diagnostic casts in semi-adjustable articulators, all patients were first offered different therapies: implant-supported FPDs (in patients with sufficient bone support), SDA (for patients with at least 20 teeth in both jaws with at least 4 occluding pairs of premolars, two on each side of jaws), or RPDs. Patients were thoroughly informed about all possible therapeutic modalities. Only those patients who chose a conventional treatment with RPDs in the maxilla were included in the study. They were further offered two options: tooth-supported FPDs in anterior regions together with RPDs in the maxilla retained by precision attachments or clasp-retained RPDs. Patients who were not willing to undergo the tooth preparation and/or could not afford precision attachment RPD treatment, due to increased cost, received clasp-retained RPDs. All patients included in the study had first-time partial denture wearers in the maxilla; however, all already had Kennedy class I mandibular RPDs.

RPDs were provided in the clinical courses of the dental school. They were strictly supervised by experienced full-time teachers and followed standardized protocol. Patients included in the study had minimum four and maximum six remaining natural teeth in the maxilla with satisfactory prognosis (no deep periodontal pockets, minimal chances for extraction within the next 5 years) and had no medical conditions that could have precluded routine dental treatment. Each patient completed a written consent form prior to the treatment and the Ethics Committee, School of Dental Medicine, University of Zagreb approved the study.

A total of 88 patients received clasp-retained RPDs, and 62 received precision attachment (ASC 52 micro; Microtecnor, Buccinasco, Italy) retained RPDs. All dentures were CoCr alloy cast frameworks. The precision attachment RPD patients also received metal-ceramic anterior FPDs with extracoronal matrices, which allowed two functional movements of a denture:
mandibular RPDs and new RPDs in the maxilla and rated denture retention and stability using a 1 to 3 scale (1 = poor quality, 2 = sufficient quality, 3 = excellent quality). Three specialists in prosthodontics separately evaluated 20 different RPDs prior to the assessment. Kappa test revealed sufficient consistency between them (0.75 to 0.90), but it was decided that only one of the dentists should evaluate all patients; however, only those patients whose RPDs were assessed as excellent were allowed to take part in the study. Other patients were excluded (three patients), as insufficient quality of their dentures could negatively affect the results.

**Questionnaires**

The OHRQoL was measured using the Croatian version of the OHIP-14 questionnaire. Patients completed the OHIP-14 questionnaires using a Likert-type scale ranging from 0 to 4. The summary scores ranged from 0 (minimum) to 56 (maximum), the higher score representing more impaired OHRQoL.

The Croatian version of the Orofacial Esthetic Scale (OES-CRO) was used to assess patients’ self-perceived orofacial esthetics. Patients rated their orofacial esthetics on a Likert scale ranging from 1 to 5 (1 = completely unsatisfied; 5 = completely satisfied); the summary scores ranged from 1 to 40. The higher summary scores indicated greater satisfaction with esthetics.

The CFQ was used to measure patients’ self-perceived chewing function. The CFQ consisted of 10 items. Patients rated their chewing ability using a Likert scale ranging from 0 to 4. Higher scores represented more impaired chewing function. The CFQ summary scores ranged from 0 to 40.

All three questionnaires were psychometrically tested in previous studies and showed excellent psychometric properties. A brief overview of the questionnaires and their items, scale used, and summary score ranges is presented in Table 1. Patients completed the questionnaires twice, first at the baseline, when they came to a dental clinic for therapy and the second time at least 3 months after they had received their new RPDs with all the necessary adjustments made.

Statistical analysis was performed with SPSS 20 for Windows. Parametric tests were used, as data (summary scores) were normally distributed (one-way Kolmogorov-Smirnov test). Paired Student t-test was used to test the significant differences between the baseline scores and the after-treatment scores for all three questionnaires for all patients. The two-factor ANOVA was performed with dependent variables: after-treatment OES; after-treatment OHIP-14, and after-treatment CFQ scores; and two factors: type of RPD retention (clasps vs. precision attachments) and gender (male, female) with the baseline score of each questionnaire as the covariate. Pearson correlation coefficients between the baseline and the after-treatment summary OES scores were also calculated. $p \leq 0.05$ was considered statistically significant.

**Results**

Mean baseline and after-treatment summary scores with standard deviations for all three questionnaires in clasp-retained
and precision attachment retained RPD patients are shown in Figure 1. The results of the paired Student t-test between the baseline and the after-treatment summary scores in the clasp-retained RPD patients, as well as in the precision attachment retained RPD patients are shown in Table 2. All patients had significantly better after-treatment scores ($p < 0.01$); however, better results (i.e., higher OES and lower OHIP-14 and CFQ after-treatment summary scores) were registered in the precision attachment RPD group than in the clasp retained RPD group (Fig 1, Table 2).

Means and standard deviations for the after-treatment OES summary scores in the clasp and the precision attachment retained RPDs of different gender are presented in Table 2. All patients had significantly better after-treatment scores ($p < 0.01$); however, better results (i.e., higher OES and lower OHIP-14 and CFQ after-treatment summary scores) were registered in the precision attachment RPD group than in the clasp retained RPD group (Fig 1, Table 2).

Means and standard deviations for the after-treatment CFQ summary scores in the clasp and the precision attachment retained RPDs of different gender are shown in Table 2. All patients had significantly better after-treatment scores ($p < 0.01$); however, better results (i.e., higher OES and lower OHIP-14 and CFQ after-treatment summary scores) were registered in the precision attachment RPD group than in the clasp retained RPD group (Fig 1, Table 2).

Means and standard deviations for the after-treatment OES summary scores in the clasp and the precision attachment retained RPDs of different gender are presented in Figure 2. The two-factor ANOVA for the dependent variable: mean OES after-treatment summary score and the two independent variables: type of RPD retention and gender, with the baseline OES summary score as the covariate (Table 3) revealed significant effect of the factor type of RPD retention, whereas the factor gender showed no significant effect; however, the combination of factors: the type of retention and gender elicited a significant effect. The covariate baseline OES summary score also showed a significant effect. Patients whose dentures were retained by precision attachments rated their esthetics significantly better (higher scores) than patients with clasp-retained RPDs. Moreover, female patients in the clasp-retained RPD group rated their esthetics significantly worse than male patients. However, female patients in the precision attachment retained RPD group rated their orofacial esthetics significantly better than male patients did. The Pearson correlation coefficient between the baseline and the after-treatment OES summary scores was 0.217, but it was significant ($p = 0.008$), indicating that patients who rated better at baseline did the same after treatment.

Means and standard deviations for the after-treatment OHIP-14 summary scores in the clasp and the precision attachment retained RPDs among male and female patients are presented in Figure 3. The two-factor ANOVA for the dependent variable: mean after-treatment OHIP-14 summary score and the two independent variables: the type of RPD retention and gender with the baseline OHIP-14 summary score as the covariate (Table 4) revealed a significant effect of the factor: the type of RPD retention, but not of gender. The mutual effect of factors: the type of RPD retention and gender was not statistically significant. The covariate baseline OHIP-14 summary score showed a significant effect. Patients whose dentures were retained by precision attachments rated their OHRQoL significantly better (lower scores) than patients with clasp retained RPDs. Female patients in the group clasp-retained RPDs rated their OHRQoL worse than male patients did (higher scores) and, contrarily, female patients in the group precision attachment retained RPD group rated their OHRQoL better than male patients (lower scores). Although not significant, the mutual effect of gender and the type of RPD retention almost reached the statistically significant level. The Pearson correlation coefficient between the baseline and the after-treatment OHIP-14 summary scores was 0.532 and was significant ($p < 0.01$).

Means and standard deviations for the after-treatment CFQ summary scores in the clasp and the precision attachment retained RPDs in male and female patients are presented in Figure 4. The two-factor ANOVA for the dependent variable: after treatment CFQ summary score and the two independent variables: type of RPD retention and gender with the baseline CFQ summary score as the covariate (Table 5) revealed significant effect of type of RPD retention and the covariate: baseline CFQ summary score, whereas the factor gender showed no significant effect. The mutual effect of factors: the type of retention and gender elicited significant effect. Female patients whose dentures were retained by precision attachments rated their chewing function better (lower scores) than female patients with clasp-retained RPDs, whereas male patients rated their chewing function almost equal in the clasp, as well as in the precision attachment retained RPDs. The Pearson correlation coefficient between the baseline and the after-treatment CFQ summary scores was 0.438 ($p < 0.01$) revealing that patients who rated better at the baseline (or worse) did the same after treatment.

![Figure 2](image-url) Mean values and standard deviations of the after-treatment OES summary scores in different types of RPD retention dependent on gender.
Table 3 Two-factor ANOVA of the dependent variable after-treatment OES summary score and two factors: type of RPD retention (clasps vs. precision attachments) and gender with the baseline OES summary scores as the covariate

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<th>Mean square</th>
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<td>1065.823</td>
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\*R^2 = 0.412 (adjusted R^2 = 0.396). *p < 0.05. **p < 0.01. NS, not significant.

Discussion

Despite various clinical possibilities offered by dental implants, therapy with RPDs is still the most common treatment option in partially edentulous patients without posterior abutment teeth. Moreover, despite the registered trend of tooth loss decline in the United States and western European countries, the need for RPDs will actually increase as the population ages and increases. Therefore, it is very important, though overlooked in the flood of papers related to dental implants, to assess treatment outcomes with RPD therapy, especially from the patients’ perspective.

Patient-based outcomes have been recently widely incorporated in the assessment of oral health components and treatment outcomes. The OHIP has been a widely used instrument for capturing the seven dimensions of OHRQoL. The shortened version (OHIP-14) meets most clinical needs with good psychometric properties. Therefore, we used the OHIP-14 questionnaire to assess different physical, psychological, and sociological dimensions of RPD therapy. We also used two unidimensional questionnaires: the OES (for patient assessment of self-perceived orofacial esthetics) and the CFQ (for assessment of self-perceived chewing function). The OES and the CFQ represented structured unidimensional questionnaires, each capturing only one dimension of orofacial well-being. The structured questionnaires describe much better certain constructs than simple questions that refer to the same construct.

We tried to choose as unique a sample as possible, and to exclude possible impacts of younger age groups on RPD wearing, only patients older than 60 years were included. Moreover, only patients who already had satisfactory clasp-retained RPDs in the mandible (Kennedy class I) were selected to avoid the influence of opposing dentition. Also, only patients with reduced palatal coverage and a U-shaped major connector were included, despite a study claiming that a degree of maxillary palatal coverage did not influence patient satisfaction. Patients with RPDs of insufficient quality (insufficient denture retention and stability) were excluded; however, some studies reported that denture quality had minimum effects on OHRQoL.

The distribution of patients into the C-RPD or PA-RPD group was not random. Most patients chose C-RPDs, as they were not willing to undergo tooth preparation. Only a small number of patients (5/62) chose C-RPDs due to the higher cost of PA-RPDs, which they were not willing to pay. The fact that they did not have enough financial support for a particular type of prosthesis could affect their level of satisfaction, because they might think that they received a worse prosthesis.

The results of this study showed significantly better after-treatment outcomes in both the C-RPD and PA-RPD groups. That was attributed to success of RPD therapy in both groups; however, better outcomes (higher OES and lower OHIP-14 and CFQ summary scores) were obtained among the PA-RPD patients compared to the C-RPD patients. Some previous clinical observations from the patients’ perspective have confirmed those outcomes.
Mean values and standard deviations of the after-treatment OHRQoL by RPD therapy are in line with other studies. However, implant-retained FPD patients (or implant-retained RPD patients) reported better OHRQoL outcomes than both groups of RPD wearers examined in the present study. The impact of RPD therapy on patients’ self-reported outcomes considering only the chewing function has not been previously obtained. The multidimensional OHRQoL questionnaire has been related to social, psychological, and physical outcomes of oral well-being. The CFQ has been related only to chewing ability. This is the first time a unidimensional structured questionnaire consisting of 10 items has been used for the assessment of chewing function outcomes among RPD patients. The structured questionnaire is certainly better than one where only one question is related to the same construct. The OES structured questionnaire was used in this study to capture only one dimension related to orofacial esthetics.

Some studies reported that besides the type of treatment, gender may also influence clinical outcomes. To test the premise, two-way ANOVA was performed with the OHRQoL, the OES, and the CFQ after-treatment summary scores as dependent variables; gender and the type of RPD retention as independent variables, and the baseline summary scores as covariates. A statistically significant effect was observed for the type of RPD retention (better self-reported outcomes were found among the PA-RPD patients compared to the C-RPD group, $p < 0.01$), but not of gender ($p > 0.05$); however, mutual interaction of gender and the type of retention yielded statistically significant effects ($p < 0.01$). Female patients in the C-RPD group were significantly more dissatisfied with the esthetic outcome, chewing ability, and OHRQoL than male patients, and vice versa in the PA-RPD group. Female patients were more focused on treatment outcomes and probably therefore overreacted in both assessments. Psychological factors and women’s higher sensitivity to their appearance could be responsible for such self-reported esthetic outcomes, which is in accordance with other studies.

The statistically significant effect ($p < 0.01$) of baseline scores noticed in all three questionnaires showed that patients with a worse self-reported oral condition benefited more from RPD therapy; however, positive correlation of the baseline scores (of all three questionnaires) with the after-treatment scores (patients who rated better at baseline did the same after the treatment) can be attributed to a patient’s personality traits, expectations, and positive or negative attitudes.

The major strength of this study was the assessment of patients’ self-reported measures related to one multidimensional construct, namely OHRQoL and two unidimensional constructs (structured questionnaires; one for self-assessment of orofacial esthetics and another for self-assessment of chewing function) in two groups of conventional RPD wearers: the C-RPD and the PA-RPD groups. The limitations of the study include unequal patient income (patients who could not afford PA-RPDs might have been related only to chewing ability.

**Table 4** Two-factor ANOVA of the dependent variable: after-treatment OHIP-14 summary score and two factors: type of RPD retention (clasps vs. precision attachments) and gender with the baseline OHIP-14 summary scores as the covariate.

<table>
<thead>
<tr>
<th>Source</th>
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<th>df</th>
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<td>926,026</td>
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* $R^2 = 0.545$ (adjusted $R^2 = 0.532$). $p < 0.05$. ** $p < 0.001$. NS, not significant.
feel they got an inferior prosthesis) and differences in the educational level. Assessment of patient personality was also not performed.

**Conclusion**

Within the limitations of this study, all RPD patients reported improved esthetics, chewing function, and OHRQoL after receiving new dentures with significantly better clinical outcomes in the PA-RPD group than the C-RPD group. Patients with good baseline assessments are also expected to have good after-treatment assessments, but patients with worse baseline scores benefited more from RPD therapy. Gender by itself yielded no significant effects, but in combination with the factor type of RPD retention, yielded significant effects. Female patients reacted more intensely than male patients, both when more (PA-RPD group) or less satisfied (C-RPD group).

**Acknowledgments**

The authors thank the Ministry of Science, Education and Sport, Croatia for funding the University Research Project: “Investigation of different prosthodontic and/or implant-prosthodontic therapeutic modalities, materials and TMD.”

**References**


