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The Quality of Removable Prostheses in Dentate, Community-Dwelling Elderly Residing in Puerto Rico

Maria L. Aguilar, DDS, MSD, MSc¹, Walter J. Psoter, DDS, PhD², Mauricio Montero, DDS, MSc³, Fabiola Milord, DDS, MPH⁴, and Kaumudi J. Joshupura, BDS, ScD⁵

¹Restorative Dental Science Department, University of Florida, College of Dentistry, Gainesville, FL

²Department of Epidemiology, New York University College of Dentistry, New York, NY

³Graduate Program, University of Costa Rica School of Dentistry, San José, Costa Rica

⁴Global Health Leadership Program, New York University New York, NY

⁵Center for Clinical Research and Health Promotion, University of Puerto Rico, School of Dental Medicine, San Juan, PR

Abstract

Purpose—Edentulism has been decreasing in the US elderly population; however, due to the increasing number of elderly, the need for prostheses has been projected to rise over the next several decades. One of the aims of the Puerto Rican Elderly Dental Health Study (PREDHS) was to assess the quality of removable prostheses (RP) in the Puerto Rican (PR) elderly (> 69 years of age) population.

Methods—A cross-sectional design, using a subgroup from the Puerto Rican Elderly: Health Conditions (PREHCO) study of dentate, community-dwelling older adults from the greater San Juan area was employed. Eligible participants were administered structured questionnaires and examined in their homes by three trained and calibrated dentists using National Institute of Dental and Craniofacial Research (NIDCR) criteria.

Results—One hundred and eighty three (183) participants were examined (61 males, 122 females) ($p < 0.001$). Overall, 64% were found to have a prosthetic problem with no statistical difference between genders. Unadjusted and age-adjusted logistic models were employed. Increasing age was associated with both upper and lower clinically defined abraded prostheses, ($p = 0.007$; $p = 0.041$, respectively). Maxillary (23%) and mandibular (27%) prostheses needed replacement due to deficiencies.

Conclusion—RP deficiencies were found in almost two-thirds of a representative sample of dentate 70+ year-old people residing in PR. There was no difference in the proportion of deficiencies between elderly who reported a dental visit in the preceding year or not having seen a dentist. A quarter of the prostheses required replacement. The findings from this and the NHANES studies demonstrate that an engaged and recognized prosthodontic dental school faculty continues to be as important now as it was a generation ago.

Keywords

Puerto Rico; removable prostheses; elderly; prostheses quality; prostheses deficiency

Correspondence: Maria Lucia Aguilar, University of Florida, College of Dentistry - Department of Prosthodontics, P.O. Box 100435 D-11 6C, Gainesville, FL 32610-0435. maguilar@dental.ufl.edu.

The authors deny any conflicts of interest.

Edentulism has been decreasing in the US elderly population since 1958¹ with the mean number of teeth retained increasing.² Due to an increasing number of elderly, however, the need and demand for removable complete and partial prostheses, as well as fixed (and implant-retained prostheses) have been projected to rise over the next several decades.^{3,4} However, retention of natural teeth rather than an absolute need for tooth replacement due to this increasing number of elderly seems to be the message partially assimilated by the profession. It has been reported that the instruction of removable prosthodontics has decreased in some dental schools,³ and that laboratory technicians state that most dentists do not follow accepted procedures for removable prosthesis (RP) fabrication,⁵ suggesting there may have been less of an emphasis on RPs in their training.

The quality of RPs has been assessed using data from the third National Health and Nutrition Survey (NHANES III),^{3,6} which was the first of the national health surveys to evaluate prosthesis quality. NHANES III was designed to provide estimates of the health and nutritional status of the US non-institutionalized civilian population aged 2 months and older using a complex, multistage sampling methodology.⁷ Redford et al reported that for NHANES III, phase 1 participants, 60% of RPs in 18- to 74-year-olds had at least one quality problem,⁶ while data for all phases demonstrated a 65% defect proportion of RPs, especially those worn on the mandible.³

Puerto Rico (PR) is a US Commonwealth; however, it is not sampled for the NHANES. To partially address the lack of PR data comparable to NHANES III, the Puerto Rican Elderly: Health Conditions (PREHCO) study, a multi-stage, clustered sample of non-institutionalized 60+ year olds, residing in PR, was conducted.

The PREDHCO study did not collect oral health data. To address oral health conditions in the elderly, the Puerto Rican Elderly Dental Health Study (PREDHS) was subsequently designed and conducted. To obtain valid population estimates by the PREDHS oral health study, the PR Elderly: Health Conditions sample was used because the PREDHS sampling was designed for producing accurate population estimates. Due to time-expense considerations, a geographic delimited sub-sample of the PREDHS was defined for the oral health study (Greater San Juan metropolitan area).

The purpose of the study described here was to assess the quality of RPs in the elderly population residing in PR.

METHODS

The PREDHS was a cross-sectional study of 183 community-dwelling, dentate elderly, 70+ years old conducted during the months of August and September, 2007. Three trained and calibrated dentists and three interviewers conducted oral examinations and structured interviews. The study was approved by the Institutional Review Board of the University of Puerto Rico Medical Sciences Campus.

Sample

The sample for the PREDHS was drawn from participants who were residents of the greater San Juan area from the second wave (2007) of the PREHCO study. The greater San Juan area includes San Juan, Bayamón, Guaynabo, Toa Alta, Toa Baja, Carolina, Trujillo Alto, and Cataño, and included 1364 participants. Inclusion criteria other than a greater San Juan residence were that the participants were 70 years of age or older, dentate, free of major cardiovascular disease, and passed the Caban mini mental exam. The exclusion criteria were

if a participant: 1) needed prophylactic medication for their periodontal examination, and 2) had participated in another sub-study.

Recruitment

In the spring of 2007, eligible participants were mailed letters introducing the study. They subsequently received telephone calls to invite the potential participant into the study and review inclusion/exclusion criteria. Those who agreed to participate and met the inclusion criteria were scheduled for a home visit for their oral examination and interview. Participants without telephones or who were unable to be contacted had a recruiter visit their home to invite them to participate in the study.

Removable prostheses' clinical deficiencies

Clinical deficiency definitions were based on NHANES III definitions.³ The definitions were reviewed by the PREDHS study prosthodontist (an examiner), two clinically experienced oral epidemiologists, and the two other examiners. The final RP deficiency definitions (applied to the RP intra- and extraorally) were:

- Prosthesis stability was determined by alternating vertical digital pressure using the index finger(s) placed on the removable partial prosthesis replacement teeth. "Rocking" of the prosthesis of 1 mm indicated a deficiency.
- Retention of a partial prosthesis was tested by applying simultaneous vertical pressure of the thumb and index finger around the prosthesis clasps on each side of the arch. Retention insufficiency was defined as having no resistance to vertical movement. Retention of a complete maxillary prosthesis was tested by attempting to dislodge it through a downward and forward pressure from the index finger applied from behind the maxillary incisors, while an upward pulling movement was applied on the mandibular central incisors of the mandibular prosthesis. Additionally, complete maxillary prostheses were tested for retention by holding the prosthetic devices bilaterally with the thumb and index fingers and applying vertical pressure. Retention insufficiency for the complete prosthesis was defined as a lack of resistance to displacement.
- When posterior prosthesis teeth lost occlusal detail or the anterior teeth had 1/3 of their posterior surface worn away, they were classified as deficient (abraded).

A prosthesis requiring an adjustment was one that did not need a reline or replacement, but needed some minor clinical correction, e.g., broken retentive clasp, pressure release from acrylic resin tissue impingement, or incorrect occlusion. The need for a reline was defined as having either a deficiency in stability or retention. The necessity for replacement prosthesis was determined when a combination of clinical deficiencies was found.

Training and calibration

Three dentist examiners were trained, standardized, and calibrated for caries and periodontal diagnoses based on the National Institute of Dental and Craniofacial Research (NIDCR) criteria by the NHANES referent examiner. Training and standardization for clinical prosthodontic deficiencies were conducted by the study prosthodontist. Prosthodontic deficiency criteria were presented and explained to the examiners, and consensus was obtained for the procedures to determine deficiency definitions. An experienced epidemiology researcher trained interviewers in conducting a structured administration of the questionnaire.

Operations

An examiner and interviewer visited each participant's home at the scheduled appointment time, and the interviewer-administered questionnaire was completed. Examinations were conducted using a portable dental chair and light, dental mirror, periodontal probe, and tongue blade following a review of the medical history and ascertainment of vital signs. Data were recorded. The interviewer then administered the study questionnaire. Universal infection control procedures were followed.

Prosthodontic examination

Prosthodontic examinations were conducted if a participant had any dental prosthesis. Type of prostheses (complete or partial) and arch (or arches), rehabilitated with prostheses were recorded. Prostheses were evaluated in and out of the mouth by the examiner for the study-defined deficiencies.

Analyses

Data were entered into Excel and imported into SPSS. Mean and standard deviations of continuous variables and frequency and percentages for categorical variables were produced. Gender differences were statistically tested by t-test, Chi-square, and Fisher's Exact test, as appropriate. Categorical variables (yes/no) were regressed on age and gender using unconditional logistic regression.

RESULTS

Three hundred and ninety two (392) eligible participants were invited to participate (Fig 1); 243 (69%) agreed to participate. After applying the exclusion criteria, 185 (47%) participants were included in the study and were interviewed and examined. One hundred and eighty three (183) participants, 2/3 being women (61 men, 122 women) ($p < 0.001$) had complete data for analysis. This sub-sample was similar to the source PREHCO demographic data on age and gender. The PREHCO sampling was designed to produce accurate estimates for the PR population.¹¹

Table 1 presents the descriptive statistics of the sample. The mean (sd) age was 78.4 (6.4) and 77.7 (5.8) years old for men and women, respectively, and both genders averaged 16 teeth. Sixty-five percent of the participants self-reported a dental visit in the previous 12 months. Thirty-one participants had edentulous maxillae, and three were edentulous in the mandible. Ninety-six participants (52%) had RPs (49% of the men, 54% of the women). Twenty-two men and 37 women had maxillary partial RPs, and 16 men and 42 women had mandibular partial RPs. The sub-sample with edentulous maxillae (31) included 5 men and 26 women, (94%) presenting with complete maxillary prostheses, and two of the three mandible edentulous participants had complete prostheses (not shown). One men and two women had single implants in their mandibles.

The findings for the clinical prosthetic examination are presented in Table 2. Clinically, 58% of the 88 participants with a maxillary prosthesis were found to have a prosthetic problem requiring a dentist's treatment, while 41.7% of the 60 participants with mandibular prostheses were found to have clinical deficiencies. Maxillary (23%) and mandibular (27%) prostheses were judged to need replacement due to deficiencies. Overall, 64% of participants were found to have a prosthetic problem with no statistical difference ($p = 0.98$) between genders, or when simultaneously adjusted for gender and age when a logistic model was employed ($p = 0.4$). Increasing age was associated with both upper and lower clinically defined abraded prostheses, 0.007 and 0.041, respectively. Age was not associated with any other clinical deficiencies at the 0.05 level when adjusted for gender; however, requiring a

maxillary reline approached statistical significance ($p = 0.052$), and any clinical problem with a maxillary prosthesis was borderline ($p = 0.056$)

DISCUSSION

This is the first population-based report on prosthesis quality in the community-dwelling, dentate PR elderly population. The sample consisted of a subsample of the PREHCO study in which the sampling methodology was designed to produce national estimates of health issues. Within the study limitations, it represents comparable age-matched data to the NHANES findings, which does not include PR. The latest NHANES prostheses data is yet to be reported; however, the PR findings are comparable to the NHANES III (1988-94) reports of 60 to 65% removable partial prosthetic deficiencies.^{3,6}

The strength of the PREDHS was in the sampling strategy as well as the training and calibration of examiners, recorders, and interviewers, which included the participation of the NHANES “gold standard” calibrator. There were, however, several limitations to consider in generalizing the results. The sample was only from the greater San Juan area and may not represent the removable prosthodontic experience of the entire island. The ages of the prostheses were not ascertained, which may be the underlying risk for deficiencies. This limitation is shared with the NHANES data. Lastly, this study sample included only those older than 69 years who were dentate. While this criterion was related to the primary purpose of the study, periodontal disease prevalence in terms of RPs, it excludes completely edentulous Puerto Ricans.

The findings of this study suggest that around two-thirds of community-dwelling elderly people in the greater San Juan area of PR have removable prosthetic deficiencies of some kind. Notably, 23% and 27% of maxillary and mandibular prostheses, respectively, needed replacement due to the deficiencies. Also of note is that 67% of the participants self-reported having visited a dentist in the past year. Not shown is that 1/3 of both those with and those without clinical deficiencies reported a dental visit within the past year. The results reported here suggest that increased removable prosthetic training for dentists may in fact be appropriate in PR, as also proposed by the NHANES report.³

The ability to masticate properly may be associated with reducing morbidity in the elderly.^{12,13} Furthermore, it has been reported that elderly patients tend to maintain prosthodontic appliances for a longer period than functionally acceptable.¹⁴ Factors that may account for such rationales are those cited by Kuthy et al, who state that “medical problems are treated as a higher priority and may ‘crowd out’ dental use.”¹⁵ However, one element that may not have a particularly strong influence on prosthetic repairs or replacement was financing; it has been reported that the elderly will seek prosthesis care regardless of insurance or source of income.¹⁵ Thus, quality of RPs should be considered in assuring the long-term health outcomes of this population.

Given the absolute numbers of patients who would benefit or demand RPs, the PR study’s findings suggest that excellence in the fabrication, subsequent accurate evaluation for deficiencies, communication regarding RPs, and skills in resolving deficiencies should be a goal of education activities for dentists. The study findings also suggest that dental research should investigate risk indicators for patient failures to follow up on dentists’ recommendations regarding necessary prosthesis repairs or replacements, patient health literacy levels in terms of prosthetic quality and deficiencies, as well as the level of technical knowledge about RPs by dental graduates.

CONCLUSION

Removable prosthesis deficiencies were found in almost two-thirds of a representative sample of dentate 70+ year-olds residing in Puerto Rico. A quarter of the prostheses required replacement. There was no difference in the proportion of deficiencies between elderly who reported a dental visit in the preceding year or not having seen a dentist and the need for replacement. The findings from this and the NHANES studies demonstrate that the importance of an engaged and recognized prosthodontic dental school faculty continues to be as important now as a generation ago.

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Figure 1.
Study recruitment flow chart

Table 1

Descriptive statistics of 183 community-dwelling, dentate elderly in Puerto Rico >69 years of age

Variable	Response	Male	Female	Total	p-value *
(N%)		61 (33.3%)	122 (66.7%)	183(100%)	<0.001 **
Age (mean, sd)		78.4 (6.4)	77.7 (5.8)	77.9 (6.0)	0.43 **
Number of the teeth (mean, sd)		16.06 (5.99)	16 (7.03)	16.03 (6.7)	0.95 **
Dental visit in the past 12 months (N, %)	Yes	37 (60.7%)	82 (67.2%)	119 (65%)	0.61 ***
	No	24 (39.3%)	39 (32.9%)	63 (34.5%)	
	Don't know	0 (0%)	1 (0.8%)	1 (1.0%)	
Number of edentulous jaws (N,%)	upper edentulous				0.35 ***
	Yes	5 (8.2%)	26 (21.3%)	31 (16.9%)	
	No	56 (91.8%)	96 (78.7%)	152 (83.1%)	
	lower edentulous				1.000 ***
	Yes	1 (1.6%)	2 (1.6%)	3 (1.6%)	
	No	60 (98.4%)	120 (98.4%)	180 (98.4%)	
Any prosthesis (N, %)	None	31 (50.8%)	56 (45.9%)	87 (47.5%)	0.54 ***
	Any	30 (49.2%)	66 (54.1%)	96 (52.5%)	
Type maxillary prosthesis (N,%)	No prostheses	34 (55.7%)	61 (50.0%)	95 (51.9%)	0.13 ***
	Partial prostheses	22 (36.1%)	37 (30.3%)	59 (32.2%)	
	Complete prostheses	5 (8.2%)	24 (19.7%)	29 (15.8%)	
Type mandibular prosthesis	No prostheses	44 (72.1%)	79 (64.8%)	123 (67.2%)	0.39 ***
	Partial prostheses	16 (26.2%)	42 (34.4%)	58 (31.7%)	
	Complete prostheses	1 (1.6%)	1 (0.8%)	2 (1.1%)	
Dental implants (N)	Mandible	1	2	3	

* Chi-square

** t-test

*** Fisher's Exact test

Table 2

Logistic regression results in 96 community-dwelling, dentate elderly in Puerto Rico >69 years of age with any removable prosthesis: (88 maxillary, 60 mandibular removable prostheses)

Variable	Response	Fisher's Exact			Logistic regression *		
		Male	Female	Total	p-value	Variables	OR CI p-value
Maxillary broken prosthesis (N, %)	Yes	3 (11.1%)	5 (8.2%)	8 (9.1%)	0.69	gender	0.78 (0.17, 3.61) 0.752
	No	24 (88.9%)	56 (91.8%)	80 (90.9%)		age	1.05 (0.94, 1.17) 0.399
Mandibular broken prosthesis	Yes	2 (11.8%)	3 (7.0%)	5 (8.3%)	0.62	gender	0.7 (0.099, 4.98) 0.724
	No	15 (88.2%)	40 (93.0%)	55 (91.7%)		age	1.08 (0.94, 1.24) 0.285
Maxillary abraded prosthesis	Yes	4 (14.8%)	14 (23.0%)	18 (20.5%)	0.28	gender	2.32 (0.63, 8.53) 0.207
	No	23 (85.2%)	47 (77.0%)	70 (79.5%)		age	1.13 (1.03, 1.24) 0.007
Mandibular abraded prosthesis	Yes	4 (23.5%)	7 (16.3%)	11 (18.3%)	0.71	gender	0.88 (0.20, 3.90) 0.863
	No	13 (76.5%)	36 (83.7%)	49 (81.7%)		age	1.12 (1.01, 1.25) 0.041
Maxillary prosthesis needs relined	Yes	4 (14.8%)	11 (18.0%)	15 (17.0%)	0.77	gender	1.52 (0.418, 5.53) 0.525
	No	23 (85.2%)	50 (82.0%)	73 (83.0%)		age	1.09 (0.999, 1.19) 0.052
Mandibular prosthesis needs relined	Yes	2 (11.8%)	8 (18.6%)	10 (16.7%)	0.71	gender	1.98 (0.36, 10.98) 0.437
	No	15 (88.2%)	35 (81.4%)	50 (83.3%)		age	1.05 (0.94, 1.17) 0.411
Maxillary prosthesis needs replacement	Yes	7 (25.9%)	13 (21.3%)	20 (22.7%)	0.78	gender	0.85 (0.29, 2.50) 0.769
	No	20 (74.1%)	48 (78.7%)	68 (77.3%)		age	1.05 (0.97, 1.14) 0.194
Mandibular prosthesis needs replacement	Yes	5 (29.4%)	11 (25.6%)	16 (26.7%)	0.76	gender	0.78 (0.23, 2.99) 0.785
	No	12 (70.6%)	32 (74.4%)	44 (73.3%)		age	1.01 (0.92, 1.10) 0.911
Maxillary prosthesis needs adjustment	Yes	11 (40.7%)	14 (23.0%)	25 (28.4%)	0.12	gender	0.45 0.17, 1.19 0.107
	No	16 (59.3%)	47 (77.0%)	63 (71.6%)		age	1.02 (0.94, 1.10) 0.661
Mandibular prosthesis needs adjustment	Yes	7 (41.2%)	13 (31.0%)	20 (33.9%)	0.55	gender	0.72 (0.21, 2.40) 0.587
	No	10 (58.8%)	29 (69.0%)	39 (66.1%)		age	1.04 (0.94, 1.14) 0.481
Any maxillary clinical deficiency	Yes	18 (66.7%)	33 (54.1%)	51 (58%)	0.351 *	gender	0.66 (0.25, 1.74) 0.4
	No	10 (58.8%)	25 (58.1%)	35 (58.3%)		age	1.08 (1.0, 1.16) 0.056
Any mandibular clinical deficiency	Yes	7 (41.2%)	18 (41.9%)	25 (41.7%)	1 *	gender	0.93 (0.29, 2.99) 0.906
	No	10 (58.8%)	25 (58.1%)	35 (58.3%)		age	0.99 (0.91, 1.07) 0.723
Any prosthetic deficiency (N, %)	Yes	19 (63.30%)	42 (63.60%)	61 (63.5%)	0.98 *	gender	0.66 (0.25, 1.74) 0.4
	No	11 (36.7%)	24 (36.4%)	35 (36.5%)		age	1.08 (1.00, 1.16) 0.056

gender adjusted for age^{*}

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