Evaluation of salivary flow, level of anxiety, and quality of life among elderly patients rehabilitated with removable prostheses

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Abstract

Background: Complete or partial edentulous patients have difficulties performing functional tasks such as eating, chewing, and speaking, and this may affect their quality of life. The successful rehabilitation of these patients depends on emotional and psychosocial factors and on patients' expectation regarding rehabilitation.

Objectives: To examine the effect of complete or partial removable prostheses on quality of life, salivary flow, and anxiety level of wearers.

Methods: Total and partial bimaxillary edentulous patients who needed rehabilitation by complete or partial removable prostheses were selected. The quality of life, salivary flow, and level of anxiety of patients were assessed using the following questionnaires: Geriatric Oral Health Assessment Index, Visual Analog Scale for xerostomia, and Anxiety Inventory. The questionnaires were used at three time points: three months before the insertion of the prostheses, at the time of insertion, and three months after the insertion of the prostheses.

Results: Our study cohort included more women (62.5%) than men (37.5%), with an average age of 65.25 years. The insertion of removable prostheses significantly influenced the quality of life, anxiety level, and salivary flow of its wearers, while decreasing the sensation of xerostomia.

Conclusions: It was deduced that the insertion of complete or partial removable prostheses influences the quality of life, anxiety level, and salivary flow of its wearers.

Background

The loss of teeth leads to an atrophy of the support structures and loss of muscular tonicity, significantly affecting the physical appearance [1–3]. Although edentulism is not necessarily a part of the natural aging process, age is still strongly associated with it [2, 3].

The majority of complete or partial edentulous patients and patients who wear the same removable dentures for years have difficulties in performing essential functional tasks such as eating, chewing, and speaking [2, 4]. The adaptation of the prosthesis base to the underlying tissues is critical to attain a suitable biomechanical response and make the prosthesis more comfortable for the patient [1]. However, the adaptation of patients to their prostheses depends largely on their expectations regarding rehabilitation as well as on emotional and psychosocial factors [2, 5–9].

In patients with removable prostheses, an increase in salivary flow could occur [2, 10] due to the presence of mechanoreceptors present in the support mucosa, and the pressure exerted by the prostheses' base produces a reflex that stimulates saliva production [11, 12].

Saliva is an essential substance in the oro-pharyngeal environment [13]. It acts as a lubricant that facilitates the swallowing of foods, begins the digestion process, and stimulates the perception of flavors,

besides having antimicrobial properties and serving as a mechanical device for cleaning the oral environment [13–15].

The regulation of salivary secretion is reflexively controlled by the sympathetic and parasympathetic divisions of the autonomic nervous system. A normal individual produces at least 500 mL of saliva per day. This value varies with changes in psychological conditions. During the day, the normal salivary flow is 0.3–0.4 mL/min, 0.1 mL/min when sleeping, and increases to 1.5–2 mL/min with a stimulated normal salivary flow [15].

Several conditions may cause a decrease in salivary flow, such as advanced age, use of certain medications, depression, anxiety, diseases of the salivary glands, Sjögren syndrome, head and neck radiation therapy, and other systemic conditions, leading to xerostomia. However, there is evidence that psychological aspects can be an important factor in the reduction of salivary flow and subjective feelings of dry mouth [16–17].

Based on the facts mentioned above, the objective of this study was to examine the influence of complete or partial removable prostheses on the quality of life, level of anxiety, and salivary flow of their wearers.

Methods

Subjects

This study enrolled 40 patients from a sample of 62 patients from the Prosthesis Clinic of the Paulista University School of Dentistry (UNIP), Manaus - Amazonas, by stratified sampling. Among the 40 patients selected, 20 were fully edentulous and 20, partially edentulous. The inclusion criteria for patient selection were the following: age older than 60 years, use of complete or partial removable bimaxillary prostheses for more than five years, presence of healthy tissues to support the prosthesis, cognitive ability, and ability to answer a questionnaire. The old prostheses should present wear of the acrylic resin teeth, a decrease of the vertical dimension of occlusion, and loss of stability. Patients with a history of neurological disease or psychiatric disorders, depression, anxiety, salivary gland disease, Sjögren's syndrome, head and neck radiation therapy, use of psychotherapeutic drugs, and other medications causing xerostomia were excluded from the study.

The participants were informed about the treatment and they signed an informed consent form, in accordance with the recommendations of the Committee on Ethics in Human Research (Procedure UNIP/CAAE: 67156417-1-0000/5512), which approved the study. After patient selection, clinical and demographic data of interest for the study were collected.

Questionnaires

The questionnaires were used at three time points: three months before the insertion of the prostheses, at the time of insertion, and three months after the insertion of the prostheses.

1. Salivary flow

The subjective assessments of salivary flow were performed using an analog visual scale that composed of eight questions related to xerostomia, which were answered by the patients. The Visual Analog Scale (VAS) for xerostomia (Appendix 1) was proposed by Pai and Ship [13], and subjectively evaluates two main aspects of salivary flow: dryness of oral mucosa (lips, mouth, tongue, or throat) and impaired oral functions due to the sensation of dry mouth (difficulty in swallowing or speaking). Two overall items regarding mouth dryness were analyzed: salivary amount and level of thirst. Patients were instructed to answer each item by marking a vertical line on a 100-millimeter horizontal scale.

2. Level of anxiety

The level of anxiety of patients was assessed by the State-Trait Anxiety Inventory (STAI) (Appendix 2). State anxiety is characterized by feelings of tension, anxiety, and nervousness, and considered to be transitory. Trait anxiety refers to relatively stable individual differences in proneness to anxiety. The stronger an individual's trait anxiety level, the more likely the experience of elevated states of anxiety during threatening situations. Each scale (State/Trait) is composed of 20 items, measured on a 4-point Likert scale, with scores ranging from 20 (Without anxiety) to 80 (Extreme anxiety) [17, 18].

3. Quality of life

Quality of life was assessed by using the Geriatric Oral Health Assessment Index (GOHAI)¹⁹ (Appendix 3), comprising 12 questions that evaluate whether the older adult has shown some degree of functional, painful, or psychological impairment due to oral health problems in the past three months. The GOHAI was specifically developed for the elderly population and allows the assessment of an individual's functioning ability in his daily routine and how he perceives his entire well-being, thus improving clinical decision making and ability to provide better oral health care.

Statistical analysis

Statistical analysis was performed using SPSS statistical software, version 24.0 (SPSS Inc., Chicago, USA). Descriptive statistical analyses (including frequency distributions and percentages) were performed on patients' demographic data and responses to all questionnaires. Scores obtained for each question were compared among the three time points using non-parametric tests. A Friedman test was applied to STAI-State, STAI-Trait, and GOHAI results, whereas two-way repeated measures of ANOVA (analysis of variance) were applied to the VAS xerostomia questionnaire, followed by a Tukey test. P values less than 0.05 were considered statistically significant.

In addition, Kendal correlation test was used to identify the correlation between the two groups ("complete denture" and "partial removable prosthesis") and STAI-State, STAI-Trait, and GOHAI results.

Pearson correlation test was performed to identify the correlation between the groups and the VAS xerostomia questionnaire. P values less than 0.05 were considered statistically significant.

Results

Patient demographics

The demographic characteristics of the treated patients are summarized in Table 1. Our study cohort included more women (62.5%) than men (37.5%), and their average age was 65.25 years (ranging from 60 to 82 years). The “complete denture” group included 35% women and 15% men, and their average age was 66.75 years, while the “partial removable prosthesis” group comprised 27.5% women and 22.5% men, and their average age was 63.75 years.

Table 1
Demographic characteristics of patients

Variables	Groups		Total
	Complete denture	Partial removable prosthesis	
Gender	6 (15.00%)	9 (22.50%)	15 (37.50%)
Male	14 (35.00%)	11 (27.50%)	25 (65.00%)
Female			
Age (years)	66.75 ± 6.40	63.75 ± 3.93	65.25 ± 5.46.

Assessment Of State Anxiety

Regarding the state anxiety scale, significant statistical differences were found in the “complete denture” group for most of the questions, except for questions 4 (“I am regretful”) and 14 (“I feel high-strung”). The results remained similar in these questions during all time points analyzed, with a predominance of the “Not at all” response. There was a significant decrease in transient anxiety levels in this group. On the other hand, the “partial removable prosthesis” group showed no significant statistical differences for most of the questions. However, there were significant differences for questions 7 (“I am currently worried about possible misfortunes”), 12 (“I feel nervous”), 14 (“I feel high-strung”), 15 (“I am relaxed”), 16 (“I feel content”), 17 (“I am worried”), and 20 (“I feel fine”) (Table 2).

Table 2
STAI-State application results - Frequency of answers per question for both groups (n = 40)

Complete denture‡					Partial removable prosthesis‡			
Questions	Initial	At time of insertion	Three months after insertion	P Value †	Initial	At time of insertion	Three months after insertion	P Value †
Q1	6 (30.0)	6 (30.0)	0 (0.0)	< 0.001*	3 (15.0)	1 (5.0)	3 (15.0)	0.607
Not at all	7 (35.0)	5 (25.0)	3 (15.0)		2 (10.0)	7 (35.0)	2 (10.0)	
Somewhat	5 (25.0)	7 (35.0)	12 (60)		10 (50.0)	11 (55.0)	10 (50.0)	
Moderately	2 (10.0)	2 (10.0)	5 (25.0)		5 (25.0)	1 (5.0)	5 (25.0)	
Very much	2 (10.0)							
Q2	5 (25.0)	7 (35.0)	2 (10.0)	< 0.001*	4 (20.0)	4 (20.0)	4 (20.0)	0.513
Not at all	7 (35.0)	5 (25.0)	5 (25.0)		5 (25.0)	5 (25.0)	5 (25.0)	
Somewhat	8 (40.0)	8 (40.0)	7 (35.0)		7 (35.0)	9 (45.0)	7 (35.0)	
Moderately	8 (40.0)	0 (0.0)	6 (30.0)		4 (20.0)	2 (10.0)	4 (20.0)	
Very much	0 (0.0)							
Q3	13 (65.0)	7 (35.0)	15 (75.0)	0.001*	11 (55.0)	6 (30.0)	11 (55.0)	0.368
Not at all	3 (15.0)	9 (45.0)	5 (25.0)		5 (25.0)	12 (60.0)	5 (25.0)	
Somewhat	2 (10.0)	3 (15.0)	0 (0.0)		4 (20.0)	2 (10.0)	4 (20.0)	
Moderately	2 (10.0)	1 (5.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Very much	2 (10.0)							
Q4	14 (70.0)	15 (75.0)	16 (80.0)	0.607	16 (80.0)	9 (45.0)	16 (80.0)	0.062
Not at all	6 (30.0)	5 (25.0)	4 (20.0)		1 (5.0)	10 (50.0)	1 (5.0)	
Somewhat	0 (0.0)	0 (0.0)	0 (0.0)		3 (15.0)	1 (5.0)	3 (15.0)	
Moderately	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Very much	0 (0.0)							

Complete denture‡					Partial removable prosthesis‡			
Q5	6 (30.0)	4 (20.0)	0 (0.0)	< 0.001*	3 (15.0)	2 (10.0)	3 (15.0)	0.276
Not at all		12 (60.0)	4 (20.0)		5 (25.0)	7 (35.0)	5 (25.0)	
Somewhat	10 (50.0)		13 (65.0)		8 (40.0)	10 (50.0)	8 (40.0)	
Moderately	4 (20.0)	4 (20.0)	3 (15.0)		4 (20.0)		4 (20.0)	
Very much	0 (0.0)	0 (0.0)				1 (5.0)		
Q6	8 (40.0)	11 (55.0)	15 (75.0)	< 0.001*	14 (70.0)	12 (60.0)	14 (70.0)	0.717
Not at all			5 (25.0)					
Somewhat	7 (35.0)	6 (30.0)	0 (0.0)		4 (20.0)	7 (35.0)	4 (20.0)	
Moderately	5 (25.0)	3 (15.0)	0 (0.0)		2 (10.0)	1 (5.0)	2 (10.0)	
Very much	0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)	0 (0.0)	
Q7	6 (30.0)	3 (15.0)	12 (60.0)	0.007*	14 (70.0)	11 (55.0)	14 (70.0)	0.007*
Not at all		14 (70.0)	7 (35.0)					
Somewhat	11 (55.0)		1 (5.0)		3 (15.0)	6 (30.0)	3 (15.0)	
Moderately	3 (15.0)	3 (15.0)	0 (0.0)		3 (15.0)	1 (5.0)	3 (15.0)	
Very much	0 (0.0)	0 (0.0)			0 (0.0)	2 (10.0)	0 (0.0)	
Q8	5 (25.0)	5 (25.0)	0 (0.0)	< 0.001*	3 (15.0)	1 (5.0)	3 (15.0)	0.670
Not at all		11 (55.0)	6 (30.0)		5 (25.0)	11 (55.0)	5 (25.0)	
Somewhat	14 (70.0)		9 (45.0)		10(50.0)		10 (50.0)	
Moderately	1 (5.0)	4 (20.0)	5 (25.0)		2 (10.0)	6 (30.0)		
Very much	0 (0.0)	0 (0.0)				2 (10.0)	2 (10.0)	

Complete denture‡					Partial removable prosthesis‡			
Q9	8 (40.0)	2 (10.0)	9 (45.0)	0.005*	10 (50.0)	7 (35.0)	10 (50.0)	0.069
Not at all	8 (40.0)	10 (50.0)	10 (50.0)		7 (35.0)	10 (50.0)	7 (35.0)	
Somewhat		8 (40.0)	1 (5.0)		2 (10.0)	2 (10.0)	2 (10.0)	
Moderately	4 (20.0)	0 (0.0)	0 (0.0)		1 (5.0)	1 (5.0)	1 (5.0)	
Very much	0 (0.0)							
Q10	5 (25.0)	1 (5.0)	0 (0.0)	< 0.001*	3 (15.0)	3 (15.0)	3 (15.0)	0.069
Not at all	9 (45.0)	12 (60.0)	3 (15.0)		4 (20.0)	9 (45.0)	4 (20.0)	
Somewhat		7 (35.0)	13 (65.0)		12 (60.0)	8 (40.0)	12 (60.0)	
Moderately	6 (30.0)	0 (0.0)	4 (20.0)		1 (5.0)	0 (0.0)	1 (5.0)	
Very much	0 (0.0)							
Q11	5 (25.0)	0 (0.0)	0 (0.0)	< 0.001*	2 (10.0)	0 (0.0)	2 (10.0)	0.513
Not at all	10 (50.0)	13 (65.0)	4 (20.0)		6 (30.0)	12 (60.0)	6 (30.0)	
Somewhat		7 (35.0)	14 (70.0)		9 (45.0)	7 (35.0)	9 (45.0)	
Moderately	5 (25.0)	0 (0.0)	2 (10.0)		3 (15.0)	1 (5.0)	3 (15.0)	
Very much	0 (0.0)							
Q12	5 (25.0)	4 (20.0)	16 (80.0)	< 0.001*	10 (50.0)	7 (35.0)	10 (50.0)	0.007*
Not at all	12 (60.0)	12 (60.0)	4 (20.0)		7 (35.0)	9 (45.0)	7 (35.0)	
Somewhat		4 (20.0)	0 (0.0)		3 (15.0)	3 (15.0)	3 (15.0)	
Moderately	3 (15.0)	0 (0.0)	0 (0.0)		0 (0.0)	1 (5.0)	0 (0.0)	
Very much	0 (0.0)							

Complete denture‡					Partial removable prosthesis‡			
Q13	11 (55.0)	11 (55.0)	15 (75.0)	0.007*	13 (65.0)	10 (50.0)	13 (65.0)	0.165
Not at all			4 (20.0)					
Somewhat	6 (30.0)	6 (30.0)	1 (5.0)		4 (20.0)	7 (35.0)	4 (20.0)	
Moderately	3 (15.0)	3 (15.0)	0 (0.0)		2 (10.0)	2 (10.0)	2 (10.0)	
Very much	0 (0.0)	0 (0.0)			1 (5.0)	1 (5.0)	1 (5.0)	
Q14	14 (70.0)	13 (65.0)	13 (65.0)	0.368	15 (75.0)	12 (60.0)	15 (75.0)	0.018*
Not at all			4 (20.0)					
Somewhat	3 (15.0)	4 (20.0)	3 (15.0)		3 (15.0)	5 (25.0)	3 (15.0)	
Moderately	3 (15.0)	3 (15.0)	0 (0.0)		0 (0.0)	1 (5.0)	0 (0.0)	
Very much	0 (0.0)	0 (0.0)			2 (10.0)	2 (10.0)	2 (10.0)	
Q15	5 (25.0)	6 (30.0)	1 (5.0)	< 0.001*	4 (20.0)	3 (15.0)	4 (20.0)	0.002*
Not at all		10 (50.0)	6 (30.0)		2 (10.0)	12 (60.0)	2 (10.0)	
Somewhat	11 (55.0)	4 (20.0)	10 (50.0)		11 (55.0)	5 (25.0)	11 (55.0)	
Moderately	4 (20.0)	0 (0.0)	3 (15.0)		3 (15.0)	0 (0.0)	3 (15.0)	
Very much	0 (0.0)							
Q16	1 (5.0)	2 (10.0)	0 (0.0)	< 0.001*	1 (5.0)	2 (10.0)	1 (5.0)	< 0.001*
Not at all		17 (85.0)	1 (5.0)		7 (35.0)	13 (65.0)	7 (35.0)	
Somewhat	15 (75.0)	1 (5.0)	17 (85.0)		12 (60.0)	5 (25.0)	12 (60.0)	
Moderately	4 (20.0)	0 (0.0)	2 (10.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Very much	0 (0.0)							

Complete denture‡					Partial removable prosthesis‡			
Q17	8 (40.0)	1 (5.0)	10 (50.0)	< 0.001*	12 (60.0)	5 (25.0)	12 (60.0)	0.011*
Not at all		14 (70.0)	9 (45.0)			12 (60.0)		
Somewhat	8 (40.0)		1 (5.0)		5 (25.0)		5 (25.0)	
Moderately		3 (15.0)			1 (5.0)	2 (10.0)	1 (5.0)	
Very much	4 (20.0)	2 (10.0)	0 (0.0)		2 (10.0)	1 (5.0)	2 (10.0)	
	0 (0.0)							
Q18	12 (60.0)	9 (45.0)	17 (85.0)	0.007*	15 (75.0)	12 (60.0)	15 (75.0)	0.165
Not at all		10 (50.0)	3 (15.0)					
Somewhat	7 (35.0)		0 (0.0)		2 (10.0)	5 (25.0)	2 (10.0)	
Moderately		1 (5.0)			3 (15.0)	3 (15.0)	3 (15.0)	
Very much	1 (5.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
	0 (0.0)							
Q19	5 (25.0)	5 (25.0)	0 (0.0)	< 0.001*	2 (10.0)	1 (5.0)	2 (10.0)	0.319
Not at all		10 (50.0)	2 (10.0)		4 (20.0)	10 (50.0)	4 (20.0)	
Somewhat	10 (50.0)		12 (60.0)		9 (45.0)		9 (45.0)	
Moderately		5 (25.0)				7 (35.0)		
Very much	5 (25.0)	0 (0.0)	6 (30.0)		5 (25.0)	2 (10.0)	5 (25.0)	
	0 (0.0)							
Q20	4 (20.0)	4 (20.0)	0 (0.0)	< 0.001*	1 (5.0)	1 (5.0)	1 (5.0)	0.002*
Not at all		10 (50.0)	3 (15.0)		6 (30.0)	11 (55.0)	6 (30.0)	
Somewhat	10 (50.0)		12 (60.0)		9 (45.0)		9 (45.0)	
Moderately		6 (30.0)				7 (35.0)		
Very much	6 (30.0)	0 (0.0)	5 (25.0)		4 (20.0)	1 (5.0)	4 (20.0)	
	0 (0.0)							
STAI-State: State Anxiety Inventory								
‡ Values in parentheses are expressed as percentages								
† Friedman test. *Significant; $P < 0.05$								

Assessment Of Trait Anxiety

The trait anxiety scale revealed statistically significant differences in both groups for most of the questions (Table 3). For the “complete denture” group, there were no significant differences for questions 3 (“I feel like crying”), 4 (“I wish I could be as happy as others seem to be”), and 14 (“I try to avoid facing a crisis or difficulty”). For the “partial removable prosthesis”, there were no significant differences for questions 4 (“I wish I could be as happy as others seem to be”), 5 (“I am losing opportunities because I cannot make decisions fast”), 9 (“I worry too much about things that do not really matter”), 12 (“I lack self-confidence”), and 18 (“I take disappointments so keenly that I cannot get them out of my mind”).

Table 3
STAI-Trait application results - Frequency of answers per question for both groups (n = 40)

Complete denture‡					Partial removable prosthesis‡			
Questions	Initial	At time of insertion	Three months after insertion	P Value †	Initial	At time of insertion	Three months after insertion	P Value †
Q1	1 (5.0)	0 (0.0)	0 (0.0)	< 0.001*	3 (15.0)	3 (15.0)	1 (5.0)	0.002*
Almost never	12 (60.0)	15 (75.0)	3 (15.0)		0 (0.0)	4 (20.0)	2 (10.0)	
Sometimes	5 (25.0)	5 (25.0)	15 (75.0)		11 (55.0)	6 (30.0)		
Often		2 (10.0)			14 (70.0)	11 (55.0)		
Almost always	2 (10.0)	0 (0.0)			2 (10.0)			
Q2	8 (40.0)	3 (15.0)	10 (50.0)	0.001*	6 (30.0)	3 (15.0)	12 (60.0)	< 0.001*
Almost never	7 (35.0)	11 (55.0)	8 (40.0)		10 (50.0)	12 (60.0)	7 (35.0)	
Sometimes	4 (20.0)	5 (25.0)	2 (10.0)		2 (10.0)	1 (5.0)		
Often		0 (0.0)			3 (15.0)	0 (0.0)		
Almost always	1 (5.0)	1 (5.0)			2 (10.0)			
Q3	18 (90.0)	16 (80.0)	18 (90.0)	0.165	11 (55.0)	9 (45.0)	15 (75.0)	0.002*
Almost never	2 (10.0)	3 (15.0)	2 (10.0)		6 (30.0)	7 (35.0)	5 (25.0)	
Sometimes	0 (0.0)	1 (5.0)	0 (0.0)		3 (15.0)	3 (15.0)	0 (0.0)	
Often		0 (0.0)			1 (5.0)	0 (0.0)		
Almost always	0 (0.0)				0 (0.0)			
Q4	10 (50.0)	12 (60.0)	11 (55.0)	0.449	15 (75.0)	13 (65.0)	16 (80.0)	0.104
Almost never	9 (45.0)	7 (35.0)	9 (45.0)		2 (10.0)	2 (10.0)	2 (10.0)	
Sometimes	1 (5.0)	1 (5.0)	0 (0.0)		3 (15.0)	0 (0.0)	0 (0.0)	
Often		0 (0.0)			2 (10.0)			
Almost always	0 (0.0)				0 (0.0)			

Complete denture‡					Partial removable prosthesis‡			
Q5	9 (45.0)	9 (45.0)	14 (70.0)	0.044*	13 (65.0)	10 (50.0)	11 (55.0)	0.186
Almost never	9 (45.0)	9 (45.0)	6 (30.0)		3 (15.0)	5 (25.0)	7 (35.0)	
Sometimes	2 (10.0)	2 (10.0)	0 (0.0)			3 (15.0)	2 (10.0)	
Often	0 (0.0)	0 (0.0)	0 (0.0)		3 (15.0)	2 (10.0)	0 (0.0)	
Almost always	0 (0.0)				1 (5.0)			
Q6	5 (25.0)	9 (45.0)	0 (0.0)	< 0.001*	3 (15.0)	2 (10.0)	0 (0.0)	< 0.001*
Almost never	14 (70.0)	5 (25.0)	6 (30.0)		9 (45.0)	14 (70.0)	4 (20.0)	
Sometimes	1 (5.0)	6 (30.0)	10 (50.0)			4 (20.0)	7 (35.0)	
Often	0 (0.0)	0 (0.0)	4 (20.0)		7 (35.0)	0 (0.0)	9 (45.0)	
Almost always	0 (0.0)				1 (5.0)			
Q7	1 (5.0)	1 (5.0)	0 (0.0)	0.038*	3 (15.0)	3 (15.0)	0 (0.0)	< 0.001*
Almost never	8 (40.0)	14 (70.0)	8 (40.0)		4 (20.0)	7 (35.0)	4 (20.0)	
Sometimes	9 (45.0)	4 (20.0)	11 (55.0)		6 (30.0)	8 (40.0)	6 (30.0)	
Often	1 (5.0)	1 (5.0)	1 (5.0)			2 (10.0)	10 (50.0)	
Almost always	2 (10.0)				7 (35.0)			
Q8	8 (40.0)	3 (15.0)	10 (50.0)	0.001*	15 (75.0)	12 (60.0)	15 (75.0)	0.039*
Almost never	10 (50.0)	14 (70.0)	10 (50.0)		2 (10.0)	4 (20.0)	5 (25.0)	
Sometimes	2 (10.0)	2 (10.0)	0 (0.0)			4 (20.0)	0 (0.0)	
Often	1 (5.0)	1 (5.0)	0 (0.0)		3 (15.0)	0 (0.0)	0 (0.0)	
Almost always	0 (0.0)				0 (0.0)			

Complete denture‡					Partial removable prosthesis‡			
Q9	5 (25.0)	2 (10.0)	9 (45.0)	< 0.001*	13 (65.0)	14 (70.0)	14 (70.0)	0.459
Almost never	11 (55.0)	8 (40.0)	10 (50.0)		4 (20.0)	3 (15.0)	4 (20.0)	
Sometimes		9 (45.0)	1 (5.0)			2 (10.0)	2 (10.0)	
Often	4 (20.0)	1 (5.0)	0 (0.0)		2 (10.0)	1 (5.0)	0 (0.0)	
Almost always	0 (0.0)				1 (5.0)			
Q10	1 (5.0)	2 (10.0)	0 (0.0)	0.005*	2 (10.0)	3 (15.0)	0 (0.0)	0.001*
Almost never	4 (20.0)	8 (40.0)	5 (25.0)		4 (20.0)	4 (20.0)	2 (10.0)	
Sometimes		9 (45.0)	8 (40.0)			11 (55.0)	9 (45.0)	
Often	11 (55.0)	1 (5.0)	7 (35.0)		7 (35.0)	2 (10.0)	9 (45.0)	
Almost always	4 (20.0)				7 (35.0)			
Q11	7 (35.0)	2 (10.0)	8 (40.0)	0.004*	13 (65.0)	8 (40.0)	13 (65.0)	0.002*
Almost never	11 (55.0)	12 (60.0)	11 (55.0)		4 (20.0)	7 (35.0)	6 (30.0)	
Sometimes		6 (30.0)	1 (5.0)			2 (10.0)	1 (5.0)	
Often	2 (10.0)	0 (0.0)	0 (0.0)		2 (10.0)	3 (15.0)	0 (0.0)	
Almost always	0 (0.0)				1 (5.0)			
Q12	9 (45.0)	5 (25.0)	13 (65.0)	0.003*	15 (75.0)	11 (55.0)	12 (60.0)	0.192
Almost never	8 (40.0)	12 (60.0)	7 (35.0)		2 (10.0)	6 (30.0)	7 (35.0)	
Sometimes		3 (15.0)	0 (0.0)			1 (5.0)	1 (5.0)	
Often	3 (15.0)	0 (0.0)	0 (0.0)		2 (10.0)	2 (10.0)	0 (0.0)	
Almost always	0 (0.0)				1 (5.0)			

Complete denture‡					Partial removable prosthesis‡			
Q13	6 (30.0)	3 (15.0)	0 (0.0)	0.002*	3 (15.0)	3 (15.0)	0 (0.0)	< 0.001*
Almost never	4 (20.0)	4 (20.0)	5 (25.0)		7 (35.0)	9 (45.0)	4 (20.0)	
Sometimes	7 (35.0)	11 (55.0)	8 (40.0)		6 (30.0)	8 (40.0)	7 (35.0)	
Often		2 (10.0)	7 (35.0)			0 (0.0)	9 (45.0)	
Almost always	3 (15.0)				4 (20.0)			
Q14	5 (25.0)	2 (10.0)	2 (10.0)	0.161	9 (45.0)	7 (35.0)	14 (70.0)	< 0.001*
Almost never	12 (60.0)	13 (65.0)	16 (80.0)		8 (40.0)	10 (50.0)	4 (20.0)	
Sometimes	3 (15.0)	4 (20.0)	2 (10.0)		0 (0.0)	0 (0.0)	2 (10.0)	
Often		0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)	
Almost always	0 (0.0)	1 (5.0)			3 (15.0)	3 (15.0)		
Q15	11 (55.0)	7 (35.0)	13 (65.0)	0.012*	16 (80.0)	8 (40.0)	12 (60.0)	0.002*
Almost never	8 (40.0)	11 (55.0)	7 (35.0)		1 (5.0)	8 (40.0)	6 (30.0)	
Sometimes	1 (5.0)	2 (10.0)	0 (0.0)		1 (5.0)	1 (5.0)	2 (10.0)	
Often		0 (0.0)	0 (0.0)			3 (15.0)	0 (0.0)	
Almost always	0 (0.0)				2 (10.0)			
Q16	1 (5.0)	3 (15.0)	0 (0.0)	0.001*	3 (15.0)	3 (15.0)	0 (0.0)	< 0.001*
Almost never	11 (55.0)	8 (40.0)	8 (40.0)		3 (15.0)	5 (25.0)	2 (10.0)	
Sometimes	6 (30.0)	9 (45.0)	8 (40.0)		6 (30.0)	9 (45.0)	7 (35.0)	
Often		0 (0.0)	4 (20.0)			3 (15.0)	11 (55.0)	
Almost always	2 (10.0)				8 (40.0)			

Complete denture‡					Partial removable prosthesis‡			
Q17	6 (30.0)	3 (15.0)	13 (65.0)	0.001*	13 (65.0)	10 (50.0)	15 (75.0)	0.045*
Almost never	10 (50.0)	12 (60.0)	4 (20.0)		4 (20.0)	8 (40.0)	3 (15.0)	
Sometimes	4 (20.0)	4 (20.0)	3 (15.0)		1 (5.0)	1 (5.0)	2 (10.0)	
Often	0 (0.0)	1 (5.0)	0 (0.0)		2 (10.0)		0 (0.0)	
Almost always								
Q18	9 (45.0)	4 (20.0)	14 (70.0)	< 0.001*	16 (80.0)	12 (60.0)	13 (65.0)	0.687
Almost never	9 (45.0)	13 (65.0)	4 (20.0)		1 (5.0)	6 (30.0)	5 (25.0)	
Sometimes	2 (10.0)	2 (10.0)	2 (10.0)		2 (10.0)	2 (10.0)	2 (10.0)	
Often	0 (0.0)	1 (5.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Almost always								
Q19	1 (5.0)	1 (5.0)	0 (0.0)	0.002*	3 (15.0)	3 (15.0)	0 (0.0)	< 0.001*
Almost never	5 (25.0)	8 (40.0)	3 (15.0)		3 (15.0)	7 (35.0)	3 (15.0)	
Sometimes	12 (60.0)	11 (55.0)	14 (70.0)		4 (20.0)	8 (40.0)	4 (20.0)	
Often	0 (0.0)	3 (15.0)	3 (15.0)		2 (10.0)	2 (10.0)	13 (65.0)	
Almost always								
Q20	6 (30.0)	4 (20.0)	12 (60.0)	< 0.001*	15 (75.0)	8 (40.0)	14 (70.0)	0.020*
Almost never	10 (50.0)	11 (55.0)	4 (20.0)		2 (10.0)	9 (45.0)	3 (15.0)	
Sometimes	3 (15.0)	2 (10.0)	4 (20.0)		2 (10.0)	2 (10.0)	2 (10.0)	
Often	0 (0.0)	3 (15.0)	0 (0.0)		1 (5.0)	1 (5.0)	1 (5.0)	
Almost always								
STAI-Trait: Trait-Anxiety Inventory								
‡ Values in parentheses are expressed as percentages								
† Friedman test. *Significant; $P < 0.05$								

Evaluation Of Salivary Flow

The analysis of the VAS xerostomia questionnaire revealed a decrease in the scores, indicating that patients reported a difference in the feeling of xerostomia at each time point. For both groups, the scores remained stable between the initial time point (before the insertion of the prosthesis) and at the time of insertion, while the feeling of xerostomia decreased three months after insertion (Table 4).

Table 4
VAS xerostomia questionnaire average results per question

Questions	Complete denture‡			Partial removable prosthesis‡			P Value †
	Initial	At time of insertion	Three months after insertion	Initial	At time of insertion	Three months after insertion	
Q1	3.72 (1.04) Aa	3.40 (1.26) Aa	2.34 (0.80) Ab	2.41 (0.74) Ba	2.56 (0.87) Ba	1.90 (0.66) Ab	0.002*
Q2	3.68 (1.13) Aa	3.46 (1.02) Aa	2.44 (0.67) Ab	2.59 (0.65) Ba	2.60 (0.74) Ba	2.07 (0.66) Ab	0.009*
Q3	3.77 (1.22) Aa	3.56 (1.39) Aa	2.45 (0.61) Ab	2.78 (0.80) Ba	2.78 (0.92) Ba	2.16 (0.71) Ab	0.051
Q4	3.40 (0.98) Aa	3.48 (1.35) Aa	2.41 (0.78) Ab	2.66 (0.73) Ba	2.77 (0.92) Aa	2.10 (0.72) Ab	0.106
Q5	3.67 (1.00) Aa	3.54 (1.21) Aa	2.61 (1.11) Ab	3.04 (0.92) Ba	3.27 (1.01) Aa	2.68 (0.90) Ab	0.003*
Q6	3.71 (0.98) Aa	3.59 (1.21) Aa	2.64 (1.05) Ab	2.84 (0.81) Ba	3.00 (0.89) Aa	2.41 (0.79) Ab	0.017*
Q7	3.57 (0.91) Aa	3.40 (1.26) Aa	2.70 (1.16) Ab	2.89 (0.62) Ba	2.85 (0.64) Aa	2.31 (0.67) Ab	0.473
Q8	3.46 (0.81) Aa	3.29 (1.11) Aa	2.68 (0.90) Ab	2.75 (0.59) Ba	2.79 (0.62) Aa	2.23 (0.54) Ab	0.341

VAS (Visual Analogue Scale) xerostomia questionnaire

‡ Values in parentheses are expressed as standard deviation

† Two-way repeated measures ANOVA: Group (complete denture and partial removable prosthesis) x Period (initial, at time of insertion, three months after insertion). *Significant; $P < 0.05$

Means followed by a different uppercase letter in the line indicate statistical differences between groups (complete denture and partial removable prosthesis) at each time point analyzed, Tukey test ($P < 0.05$). Means followed by a different lowercase letter in the line indicate statistical differences at each time point (initial, at time of insertion, three months after insertion) for each group analyzed, Tukey test ($P < 0.05$).

Evaluation Of Quality Of Life

The GOHAI¹⁹ results showed that there were significant improvements in the quality of life of the “complete denture” group among the time points analyzed. On the other hand, quality of life data remained stable among the time points in the “partial removable prosthesis” group (Table 5).

Table 5
GOHAI application results - Frequency of answers per question for both groups

Questions	Complete denture‡				Partial removable prosthesis‡			
	Initial	At time of insertion	Three months after insertion	P Value †	Initial	At time of insertion	Three months after insertion	P Value †
Q1	8 (40.0)	9 (45.0)	14 (70.0)	0.001*	11 (55.0)	10 (50.0)	15 (75.0)	0.070
Never		8 (40.0)	5 (25.0)				4 (20.0)	
Sometimes	6 (30.0)	3 (15.0)	1 (5.0)		6 (30.0)	7 (35.0)	1 (5.0)	
Always	6 (30.0)				3 (15.0)	3 (15.0)		
Q2	5 (25.0)	5 (25.0)	14 (70.0)	< 0.001*	7 (35.0)	6 (30.0)	14 (70.0)	0.001*
Never		8 (40.0)	5 (25.0)			7 (35.0)	6 (30.0)	
Sometimes	12 (60.0)	7 (35.0)	1 (5.0)		6 (30.0)	7 (35.0)	0 (0.0)	
Always	3 (15.0)				7 (35.0)			
Q3	10 (50.0)	8 (40.0)	15 (75.0)	< 0.001*	11 (55.0)	12 (60.0)	18 (90.0)	0.010*
Never		8 (40.0)	5 (25.0)				2 (10.0)	
Sometimes	8 (40.0)	4 (20.0)	0 (0.0)		5 (25.0)	5 (25.0)	0 (0.0)	
Always	2 (10.0)				4 (20.0)	3 (15.0)		
Q4	8 (40.0)	6 (30.0)	17 (85.0)	< 0.001*	11 (55.0)	11 (55.0)	15 (75.0)	0.202
Never		9 (45.0)	3 (15.0)				3 (15.0)	
Sometimes	8 (40.0)	5 (25.0)	0 (0.0)		4 (20.0)	4 (20.0)	2 (10.0)	
Always	4 (20.0)				5 (25.0)	5 (25.0)		
Q5	6 (30.0)	7 (35.0)	15 (75.0)	< 0.001*	8 (40.0)	9 (45.0)	14 (70.0)	0.003*
Never		8 (40.0)	4 (20.0)			7 (35.0)	6 (30.0)	
Sometimes	9 (45.0)	5 (25.0)	1 (5.0)		8 (40.0)	4 (20.0)	0 (0.0)	
Always	5 (25.0)				4 (20.0)			

Complete denture‡					Partial removable prosthesis‡			
Q6	9 (45.0)	11 (55.0)	19 (95.0)	0.001*	12 (60.0)	10 (50.0)	19 (95.0)	0.003*
Never			0 (0.0)				1 (5.0)	
Sometimes	7 (35.0)	7 (35.0)	1 (5.0)		6 (30.0)	7 (35.0)	0 (0.0)	
Always	4 (20.0)	2 (10.0)			2 (10.0)	3 (15.0)		
Q7	13 (65.0)	4 (20.0)	2 (10.0)	0.003*	5 (25.0)	8 (40.0)	12 (60.0)	0.162
Never		12 (60.0)	9 (45.0)			10 (50.0)	7 (35.0)	
Sometimes	4 (20.0)		9 (45.0)		11 (55.0)		1 (5.0)	
Always	3 (15.0)	4 (20.0)			4 (20.0)	2 (10.0)		
Q8	13 (65.0)	12 (60.0)	17 (85.0)	0.062	14 (70.0)	13 (65.0)	18 (90.0)	0.191
Never			3 (15.0)				2 (10.0)	
Sometimes	5 (25.0)	7 (35.0)	0 (0.0)		5 (25.0)	6 (30.0)	0 (0.0)	
Always	2 (10.0)	1 (5.0)			1 (5.0)	1 (5.0)		
Q9	5 (25.0)	12 (60.0)	15 (75.0)	< 0.001*	11 (55.0)	11 (55.0)	16 (80.0)	0.218
Never			5 (25.0)				3 (15.0)	
Sometimes	10 (50.0)	7 (35.0)	0 (0.0)		7 (35.0)	8 (40.0)	1 (5.0)	
Always	5 (25.0)	1 (5.0)			2 (10.0)	1 (5.0)		
Q10	5 (25.0)	10 (50.0)	16 (80.0)	< 0.001*	14 (70.0)	12 (60.0)	17 (85.0)	0.122
Never			3 (15.0)				3 (15.0)	
Sometimes	12 (60.0)	7 (35.0)	1 (5.0)		3 (15.0)	7 (35.0)	0 (0.0)	
Always	3 (15.0)	3 (15.0)			3 (15.0)	1 (5.0)		
Q11	6 (30.0)	9 (45.0)	18 (90.0)	< 0.001*	12 (60.0)	10 (50.0)	16 (80.0)	0.115
Never		9 (45.0)	2 (10.0)				3 (15.0)	
Sometimes	10 (50.0)	2 (10.0)	0 (0.0)		6 (30.0)	7 (35.0)	1 (5.0)	
Always	4 (20.0)				2 (10.0)	3 (15.0)		

Complete denture‡					Partial removable prosthesis‡			
Q12	8 (40.0)	5 (25.0)	15 (75.0)	0.002*	9 (45.0)	5 (25.0)	6 (30.0)	0.336
Never		13 (65.0)	5 (25.0)			12 (60.0)	12 (60.0)	
Sometimes	9 (45.0)		0 (0.0)		7 (35.0)		2 (10.0)	
Always	3 (15.0)	2 (10.0)			4 (20.0)	3 (15.0)		
GOHAI: General Oral Health Assessment Index								
‡ Values in parentheses are expressed as percentages								
† Friedman test. *Significant; $P < 0.05$								

Cross-analysis Of Data

A correlation was found between both groups for STAI-State, GOHAI, and VAS xerostomia questionnaire, while there was no correlation between the groups for STAI-Trait (Table 6). The correlation between the groups for STAI-State was positive ($P = 0.044$), whereas for GOHAI ($P = 0.011$) and VAS xerostomia questionnaire ($P < 0.001$), the correlation was negative.

Table 6
Correlation between groups and questionnaires applied in the study

Correlation		STAI-State‡	STAI-Trait‡	GOHAI‡	VAS Xerostomia Questionnaire†
Groups	Correlation coefficient	0.038*	-0.030	-0.065*	-0.291**
	Significance	0.044	0.119	0.011	< 0.001
‡ Kendal correlation, $P < 0.05$.					
† Pearson correlation, $P < 0.05$					
* Correlation is significant at the 0.05 level.					
** Correlation is significant at the 0.01 level.					

Discussion

The demographic data showed that this study cohort included more women (62.5%) than men (37.5%), and their average age was 65.25 years (ranging from 60 to 82 years). The “complete denture” group included 35% women and 15% men, and their average age was 66.75 years, while the “partial removable prosthesis” group comprised 27.5% women and 22.5% men, and their average age was 63.75 years.

These results corroborate other studies [2, 20, 21] that have found that most edentulous patients are women with an average age of 65 years.

This study evaluated the salivary flow of elderly patients rehabilitated with complete and partial removable prostheses. Saliva plays an essential role in oral health; it has a buffer effect on the acids, aids in cleaning the oral cavity, contains antibodies, and helps prevent erosions and ulcers of the mucosa [22, 23]. When salivary flow decreases, there is an increased risk of patients developing diseases such as candidiasis and prostheses causing discomfort, as compared to patients with normal salivary flow [24]. Xerostomia can be caused by several factors, such as advanced age, anxiety, depression, dysfunctions in salivary glands, Sjögren's syndrome, medications, head and neck radiation, and systemic changes such as diabetes mellitus [25].

In patients who use complete and partial removable prostheses, the mechanical action of saliva is needed to assist in the retention of the prostheses. It has been reported that patients who use complete prostheses and have xerostomia exhibit more severe points of ulceration than patients with normal salivary flow [13]. Therefore, xerostomia and salivary hypofunction may have adverse effects in totally or partially edentulous patients and wearers of prostheses, thus affecting chewing, swallowing, speech, and taste [13–17].

Elderly patients tend to have a prevalence of dry mouth, and this can be explained by their consumption of xerogenic drugs that affect the perception and production of saliva; other causes of dry mouth in elderly patients include autoimmune diseases or radiotherapy in malignant lesions [25]. However, in this study, there was a decrease in the scores of the VAS xerostomia questionnaire in both groups, indicating that patients reported a lower sensation of dry mouth among the time points analyzed.

The xerostomia scores of the two groups remained stable between the initial time point and at the time of insertion, while the feeling of xerostomia decreased three months after insertion (Table 4). This likely occurs because the prostheses are perceived as a foreign body and, thus, more saliva is secreted to promote better lubrication and defense [11, 26]. In addition, prostheses cause chronic stimulation of mechanoreceptors, which can increase the salivary reflex through the pressure caused by them. This corroborates the study by Wolff et al. (2004) [11], who observed an increase in patients' salivation after the insertion of conventional complete prostheses.

However, patients with high levels of anxiety may experience decreased salivary flow and, consequently, a sensation of dry mouth [27, 28]. The salivary glands have sympathetic and parasympathetic innervation, and both promote salivary secretion. Sympathetic activity is intensified by stress, anxiety, and depression. As a result, there is a decrease in serous salivary secretion, which constitutes the major part of normal total saliva, and an increase in mucous secretion, resulting in a lower volume of flow and an increase in saliva viscosity [28].

State anxiety is a transient emotional condition that consists of consciously perceived feelings of tension, apprehension, and hyperactivity of the autonomous nervous system. State anxiety scores

fluctuate over time and vary in intensity depending on the perceived danger. Trait anxiety, in turn, presents relatively stable individual differences in the tendency to react to situations perceived as threatening. Thus, trait anxiety scores are less sensitive to changes arising from environmental situations and remain relatively constant over time [29].

These facts were observed in this study, with state anxiety presenting greater variations over the time points evaluated, while trait anxiety scores remained more constant (Tables 2 and 3). These data corroborate the study by Hashem et al. (2006) [29], which evaluated the anxiety of 18 patients before and after three and six days the placement of dental implants using the STAI and found no statistically significant difference in the trait anxiety over the evaluated time points.

Concerning the questionnaire that evaluates state anxiety, there was a decrease in the level of significant transient anxiety in the “complete denture” group. Furthermore, anxiety levels and the sensation of hyposalivation also decreased during all assessed time points in both groups. This confirms that psychological factors are associated with hyposalivation and subjective oral dryness, playing a crucial role in the etiology of these conditions. In contrast, anxiety levels among time points remained low in the “partial removable prosthesis” group.

Naumova et al. (2012) [23], evaluated the relationship between stress and salivary secretion, finding no relationship between them; in other words, stress did not reduce salivary flow. However, when evaluating the proteins present in saliva, they observed an increase in their concentration after exposure to stress, leading to the conclusion that the main cause for dry mouth sensation during stressful situations was not the reduction of salivary flow, but the change in saliva composition.

The etiology of anxiety is complex and multifactorial. During prosthetic rehabilitation, the anxiety can be aggravated by feelings of embarrassment and shame, as well as by the possibility that the treatment would not be successful [23]. The psychological impact of this treatment is strongly influenced by the type of limitation an individual experiences in their quality of life as a consequence of edentulism. Therefore, patients’ satisfaction with this treatment option is of utmost importance during its planning and implementation, as even patients who apparently conform well to dental losses tend to have high expectations from their prostheses [27].

In this study, the rehabilitation of total and partial edentulous elderly patients concerning their quality of life was also assessed with the GOHAI questionnaire. The improvement of patients’ quality of life using removable prosthetics is proportional to the satisfaction with rehabilitation, and several factors are considered important for higher patient satisfaction [2]. Specifically, the “complete denture” group showed a significant improvement in their quality of life over the study period.

One of the most serious consequences of edentulism and the use of maladaptive prostheses is social isolation. Edentulism can negatively affect the social life of patients, which can be reduced through rehabilitation with new complete prostheses or implant-retained prostheses [30]. Patients with partial removable dentures do not suffer the full impact of edentulism, and this may be reflected in the results of

this study, which showed that in the “partial removable prosthesis” group, quality of life data remained stable over the time points analyzed.

Conclusions

Considering the limitations of this study, and being a pilot study, we can conclude that:

- - The insertion of complete removable prostheses can significantly influence the quality of life, level of anxiety, and salivary flow of their wearers.
- - The insertion of complete and partial removable prostheses decreases the sensation of xerostomia.
- - Over the time points evaluated, the feeling of dry mouth was slightly felt by wearers of partial removable prostheses and significantly felt by wearers of complete prostheses.
- - The sensation of hyposalivation that can be felt by patients with removable prosthetics decreases as the levels of anxiety decrease.

Abbreviations

STAI - State-trait anxiety inventory

VAS - Visual analogue scale

ANOVA - Analysis of variance

GOHAI - Geriatric Oral Health Assessment Index

UNIP - Paulista University School of Dentistry

CAAE - Certificate of presentation for Ethical Appreciation

Declarations

Ethics approval and consent to participate

The present study was approved by the Research Ethics Committee of the Paulista University School of Dentistry – (BRAZIL).

Certificate of Presentation for Ethical Appreciation (67156417-1-0000/5512) (Protocol N° 2070/157). Selected patients received verbal and written information about the treatment and research, and signed an informed consent form, in accordance with the recommendations of the Ethics Committee on Human Research.

Consent for publication

We informed the patients that the study would be published in an International Journal. The patients were of low income and with little education; therefore, all information about the study was explained in a simplified way. The ethics committee approved in Brazil means that the study may use human patients and may be published later.

Availability of data and material

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable.

Authors contributions

LCB, DMS and CASP participated in the concepts and coordination of the study, drafted the manuscript and performed the study design. NVAM, CLMMN, EVFS and MCG conceived the study, participated in acquisition of data and helped to draft the manuscript. All authors read and approved the final manuscript.

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