Association Between Use of Removable Partial Dentures and Presence of Crown and Root Caries in Institutionalized Elders in Bogotá *

Asociación entre uso de prótesis parcial removible y presencia de caries coronal y radicular en adultos mayores institucionalizados de Bogotá

Associação entre o uso de próteses parciais removíveis e a presença de cárie de coroa e raiz em idosos institucionalizados em Bogotá

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Abstract:

Background: The use of removable partial dentures (RPD) has been associated with the presence of dental caries. Aim: To explore in partially dentate institutionalized elderlies from Bogotá the correlation of the presence of dental caries with the use of RPD and, with practices its use and care. Methods: Three dentists assessed the presence of active/inactive coronal/radicular caries lesions

using ICDAS visual criteria and, in RPD carriers, their care practices, using a questionnaire. A descriptive analysis and exploration of correlations were carried out using a bivariate model, with the presence of at least one coronal/radicular caries/active caries lesion as the outcome variable. Results: In a universe of 226 individuals aged 80.1±9.3 years, predominantly women (63.7 %), it was found that 69 used RPD in at least one maxilla. The latter had an average age of 80.5±9.5 years and 8.4±5.9 teeth. The prevalence of coronal caries lesions was 43.5 % and radicular 50.7 %, mainly active (80.0 % and 85.7 % respectively). RPD wearers had less coronal caries/active coronal caries than non-users. In the RPD group, the number of people who cleaned them daily and did not have active root caries was significantly higher than that of those who did not. The number of individuals without root caries who cleaned their RPDs ≥2 times per day was significantly higher than those who brushed less frequently ($p<0.05$). Conclusion: A correlation was found between RPD care practices and the presence of root caries.

Keywords: aging, Bogota, Colombia, chronic noncommunicable diseases, crown caries, dental caries, dentistry, elderly, partial denture, oral health, root caries.

Resumen:

Antecedentes: El uso de prótesis parcial removible (PPR) se asocia con presencia de caries dental. Objetivo: explorar en adultos mayores institucionalizados parcialmente dentados de Bogotá la correlación de la presencia de caries dental con el uso de PPR y, con prácticas de su uso y cuidado. Métodos: tres odontólogos valoraron presencia de lesiones de caries coronal/radicular activa/inactiva con criterios visuales ICDAS y, en portadores de PPR las prácticas de su cuidado, mediante cuestionario. Se realizó análisis descriptivo y exploración de correlaciones mediante modelo bivariado, con presencia de al menos una lesión de caries/caries activa coronal/radicular como variable desenlace. Resultados: Dentro de un universo de 226, se encontró que 69 usaban PPR en al menos un maxilar. Estos últimos, con predominio de mujeres (66.7 %), tenían un promedio de 80.5±9.5 años y de 8.4±5.9 dientes. La prevalencia de lesiones de caries coronal fue de 43.5 % y radicular de 50.7 %, principalmente activas (80.0 % y 85.7 %, respectivamente). Los que portaban PPR tenían menos caries coronal/caries coronal activa que quienes no las usaban. En el grupo de PPR, el número de personas que las limpiaban diariamente y no tenían caries radicular activa era significativamente mayor que el de quienes no lo hacían. El número de individuos sin caries radicular que limpiaba sus PPR ≥2 veces por día era significativamente mayor que el de quienes tenían una frecuencia menor de cepillado ($p<0.05$). Conclusión: Se encontró correlación entre prácticas de cuidado de las PPR y la presencia de caries radicular.

Palabras clave: adulto mayor, Bogotá, Colombia, caries coronal, caries dental, caries radicular, dentadura parcial, enfermedades crónicas no transmisibles, envejecimiento, odontología, salud bucal, salud oral.

Resumo:

Antecedentes: O uso de próteses parciais removíveis (PPR) está associado à presença de cárie dentária. Objetivo: explorar a correlação da presença de cárie dentária com o uso de PPR e seu uso e práticas de cuidado em idosos institucionalizados parcialmente dentados em Bogotá. Métodos: três dentistas avaliaram a presença de lesões de cárie coronais/radiculares ativas/inativas com critérios visuais do ICDAS e, em portadores de PPR, suas práticas de cuidado, por meio de um questionário. Uma análise descritiva e exploração de correlações foram realizadas usando um modelo bivariado, com a presença de pelo menos uma lesão coronal/radicular/cárie ativa como variável de resultado. Resultados: Dentro de um universo de 226, 69 foram encontrados para usar PPR em pelo menos uma mandíbula. Estes últimos, com predominância de mulheres (66,7%), tinham idade média de 80,5±9,5 anos e 8,4±5,9 dentes. A prevalência de lesões de cárie coronal foi de 43,5% e radicular de 50,7%, principalmente ativas (80,0% e 85,7%, respectivamente). Os usuários de PPR tiveram menos cáries coronais/cáries ativas do que os não usuários. No grupo de PPRs, o número de pessoas que os limpavam diariamente e não tinham cárie radicular ativa foi significativamente maior do que aqueles que não tinham. O número de indivíduos sem cárie radicular que limparam seus PPRs ≥2 vezes ao dia foi significativamente maior do que aqueles que escovaram com menos frequência ($p<0,05$). Conclusão: Foi encontrada uma correlação entre as práticas de cuidado PPR e a presença de cárie radicular.

Palavras-chave: Bogotá Colômbia, cárie de coroa, cárie, cárie radicular, envelhecimento, idoso, doenças crônicas não transmissíveis, odontologia, prótese parcial, saúde bucal, saúde oral.

INTRODUCTION

The prevalence of edentulism has decreased significantly over the past two decades (1-5), with a 45% reduction in the global prevalence of total tooth loss and its incidence rate when standardized by age (6). However, pathologies associated with dental loss, such as periodontal disease and dental caries, remain highly prevalent (7,8). According to the World Health Organization (WHO), maintaining at least 10 teeth per

arch is essential for functional mastication (9,10). A decrease below this threshold leads to a reduction in occlusal pairs, resulting in nutritional disorders and a diminished quality of life related to oral health (11). Among the Colombian population, the average number of teeth present was reported to be 8.0 (12), while the institutionalized elderly population had an average of 10.8 ± 7.3 teeth (13).

The use of removable partial dentures (RPDs) offers an alternative to restore masticatory function in individuals experiencing tooth loss (14-16). However, these devices have been suggested to negatively impact oral health by promoting biofilm accumulation in the absence of adequate oral hygiene (17), potentially increasing the risk of carious lesions (18). Studies examining the relationship between the use of RPDs and the presence of carious lesions have yielded inconsistent findings.

In Colombia, studies exploring the association between RPD use and the presence of crown and root caries in institutionalized older adults are lacking. This study aims to address this gap by investigating the correlation between RPD use and caries presence in institutionalized older adults in Bogotá. The results are expected to contribute to the development of prevention strategies focusing on lifestyle factors and care practices for older adults with RPDs.

MATERIALS AND METHODS

The correlation of the use of RPD and care practices with the presence of at least one carious lesion or active coronal/radicular carious lesion was explored, within a cross-sectional descriptive observational study, which was appropriate by the Committee on Ethics in Research of the El Bosque University (Act 012-2016) (13). This study included older adults (>59 years) residing in geriatric institutions in the city, who voluntarily agreed to participate and signed the informed consent. Those with severe mental disability, limited opening or terminal illness were excluded.

An observational study with a cross-sectional descriptive design was conducted to explore the correlation between RPD use, care practices, and the presence of at least one carious lesion or active coronal/radicular lesion. The study received appropriate from the Research Ethics Committee of El Bosque University (Act No. 012-2016). Participants included individuals aged 60 years and older residing in geriatric institutions in Bogotá, who provided informed consent. Exclusion criteria included severe mental disability, limited mouth opening, and terminal illness.

Clinical evaluations were conducted using basic examination instruments (mirror and WHO probe) in geriatric institution chairs, under white light, and without the use of compressed air. Three calibrated dentists (inter- and intra-examiner reproducibility kappa > 0.7) assessed and classified the presence of dental caries, defined as the localized destruction of the tooth's hard tissues, and evaluated the activity status of these lesions without using compressed air (ICDASepi) (19,20).

According to caries severity, coronal lesions were classified as follows (19,20):

- **Initial lesion:** The first visible or detectable change in enamel seen as caries opacity or visible discoloration (white and/or brown stain lesion), inconsistent with clinical evidence of healthy enamel (ICDAS codes 1 or 2). These lesions showed no evidence of surface breakdown or underlying dentin shadow.
- **Moderate lesion:** A white or brown stain lesion with localized enamel breakdown, but without visible exposed dentin (ICDAS code 3), or an underlying shadow of dentin originating from the tested surface (ICDAS code 4).
- **Severe lesion:** A detectable cavity in opaque or discolored enamel with visible dentin (ICDAS codes 5 or 6).

Root lesions, based on severity, were classified as (19,20):

- **Initial lesion:** A color change without cavitation, with tissue loss < 0.5 mm.
- **Moderate/severe lesion:** The presence of cavitation ≥ 0.5 mm.

Lesions were categorized as active if they exhibited a white/yellowish color in the enamel, appeared opaque with loss of shine, and were rough when gently probed with a round-tipped instrument. These lesions were typically located in biofilm retention areas. Similarly, dentin lesions were considered active if they were soft or leathery upon probing and were either covered or not by thick biofilm before cleaning (19,20).

RPD use was documented, along with information on cleaning frequency and whether the RPDs were removed during sleep.

Statistical Analysis

A descriptive analysis was carried out under a bivariate model. The statistical significance of the bivariate correlation was determined with the Pearson $\chi 2$ test. Values $p < 0.05$ were considered significant. Data analysis was performed with the Stata software version. 14.

Descriptive analysis was conducted under a bivariate model to evaluate correlations. Pearson's $\chi 2$ test determined statistical significance ($p < 0.05$). Data analysis was performed using Stata software version 14.

RESULTS

Demographic Characteristics

Out of 226 dentate elderly individuals assessed, 69 used RPDs in at least one arch. This subgroup predominantly comprised women (66.7 %) with an average age of 80.5 ± 9.5 years. The average number of teeth in this population was 8.4 ± 5.9 (table 1).

TABLE 1
Demographic Characteristics of Non-Carriers and Carriers of Removable Partial Dentures

Variable	Indicator	Not RPD carriers (N=157)		RPD carriers (N=69)	
		n	%	n	%
Sex	Female	144	63.7	46	66.7
	Male	82	36.3	23	33.3
Age	60-69	34	15.0	11	15.9
	70-79	59	26.1	16	23.2
	80-89	101	44.7	30	43.5
	≥90	32	14.2	12	17.4

Source: the authors.

Among the RPD users, these devices were used predominantly in the lower jaw (53.6%), followed by similar percentages in the upper jaw and both arches (23.2%). The distribution of RPD usage per maxilla is detailed in Table 2. Regarding material composition, RPDs were primarily acrylic, with 72.5% used in the upper jaw (n = 50) and 50.7% in the lower jaw (n = 35).

TABLE 2
Distribution of the Use of Removable Partial Dentures and Denture Material Per Arch

Variable	Indicator	Maxillary arch n (%)	Mandibular arch n (%)
Use	Yes	32 (46.4)	52 (75.4)
	No	37 (53.6)	17 (24.6)
Material	Acrylic	50 (72.5)	35 (50.7)
	Combined (acrylic and cobalt-chrome)/skeletal	8 (11.6)	24 (34.8)
	Does not have	11 (15.9)	10 (14.5)

Source: the authors

In the RPD users, assessed using ICDAS visual criteria, the entire population showed caries experience, with an average modified superficial DFMT of 102.2 ± 21.2. Tooth loss contributed the most to this indicator (90.9 ± 26.0), followed by filled surfaces (9.1 ± 12.1) and carious lesions (2.2 ± 5.4; initial: 0.3 ± 0.5; moderate: 0.1 ± 0.4; severe: 0.1 ± 0.4). Slightly less than half of the individuals (43.5%) had at least one coronal carious lesion, most of which were in an active state (80.0%).

More than half of the population (53.6%) exhibited caries experience involving filled and carious surfaces, with an average of 2.0 ± 2.9 surfaces distributed across carious lesions (1.5 ± 4.0; initial: 0.6 ± 1.7; moderate: 0.3 ± 0.9; severe: 0.6 ± 1.4) and filled surfaces (0.6 ± 1.3). Half of the older adults who used RPDs had at least one root caries lesion (50.7%), the majority of which were active (85.7%).

The bivariate analysis of RPD use and care practices versus dental caries showed statistically significant differences ($p<0.05$). Among the 226 older adults studied, it was observed that RPD users had fewer coronal caries and active coronal caries than non-users. However, no significant associations were found between RPD use and root caries (Table 3).

TABLE 3
Correlation Between the Use of Removable Partial Dentures and the Presence of Caries (N=226) in Older Adults

RPD Use	Coronal Caries		P	Active Coronal Caries		P	Root Caries		P	Active Root Caries		P
	Yes	No		Yes	No		Yes	No		Yes	No	
Yes	30 (43.5)	39 (56.5)	**0.028**	24 (34.8)	45 (65.2)	**0.001**	35 (50.7)	34 (49.3)	0.347	30 (43.5)	39 (56.5)	0.514
No	93 (59.2)	64 (40.8)		91 (57.9)	66 (42.0)		69 (43.9)	88 (56.0)		61 (38.8)	96 (61.1)	

Source: the authors.

In the group of RPD carriers (n = 69), it was observed that the number of individuals who cleaned their RPDs daily and did not have active root caries was significantly higher than those who did not clean their RPDs and did not exhibit this pathology. Similarly, the number of individuals without root caries who cleaned their RPDs at least twice a day was significantly greater than those who cleaned less frequently (Table 4).

TABLE 4
Correlation in Older Adults with RPD between Care Practices and Dental Caries (N=69)

Variable	Indicator	Presence of ≥ 1 coronal caries lesion		P	Presence of ≥ 1 active coronal caries lesion		P	Presence of ≥ 1 root caries lesion		P	Presence of ≥ 1 active root caries lesion		P
		Yes	No		Yes	No		Yes	No		Yes	No	
RPD cleaning	Yes	23	28	0.648	19	32	0.468	20	31	0.229	22	29	**0.034**
	No	7	11		5	13		10	8		13	5	
Frecuencia diaria de limpieza de RPD	≥2	25	29	0.370	20	34	0.456	24	30	**0.048**	22	32	0.384
	<2	5	10		4	11		11	4		8	7	
Retiro nocturno de la RPD	Yes	14	14	0.366	10	18	0.893	13	15	0.683	15	13	0.696
	No	16	25		14	27		17	24		20	21	

Source: the authors.

This study also explored the correlation between RPD material (acrylic or combined) and biofilm accumulation for each dental arch. No statistically significant differences were observed between the two material types regarding biofilm accumulation ($p = 0.81$ for the maxillary arch and $p = 0.98$ for the mandibular arch).

DISCUSSION

Even with the global decrease in edentulism, tooth loss continues to be a common issue among older adults, with peak incidence observed around the age of 65 (21). In this study, institutionalized older adults with RPDs were evaluated, showing that the average number of teeth per individual was less than 50 % of the 20 teeth required for functional mastication (9,10). This finding aligns with data from the reference Colombian population (12).

Dental caries, one of the leading causes of tooth loss (7,8), was found to affect approximately half of the RPD-using population, particularly in cases of root caries, with a slightly lower prevalence for coronal caries. Considering the significant impact of dental caries on quality of life and its associated economic burden (22), these results highlight the severity of oral health challenges among the elderly. The findings may reflect gaps in the health coverage and services provided in Colombia.

Two elements from Resolution No. 3280 of 2018 could help explain these gaps: 1) individuals over the age of 19 are explicitly excluded from systematic caries prevention programs, such as the biannual application of fluoride varnish, and 2) for the elderly population, biennial care is limited to prophylaxis and plaque removal, with scaling only performed when deemed necessary by the dental professional (23).

The deterioration in chewing ability that occurs with tooth loss is associated with reduced nutrient intake and poor nutritional status. In this regard, the restoration of function with the use of RPDs has been shown to have a positive impact on nutritional status (14). Due to their lower cost compared to other oral rehabilitation options, RPDs are often the preferred dental replacement when financial constraints are a factor (24).

According to the bivariate model used in this study, RPD users did not have higher rates of coronal caries or active coronal caries. This finding aligns with the review by Thomson (2004), which explored caries experience in older adults and associated factors (25).

Prostheses are considered "biofilm traps" (26), where biofilm forms shortly after being introduced into the oral cavity, similar to the surface of natural teeth (27). Given that this study focuses on older adults, it is important to consider that gingival recessions are common in this population, exposing root surfaces that

are at higher risk for caries (28). As a result, the relationship of RPDs is more directly associated with root surfaces than with coronal ones.

The presence of biofilm does not necessarily lead to caries formation. However, biofilm is a significant risk factor, and its control through regular hygiene practices is essential for maintaining good oral health (26). Puskar and Blažiće (2005) conducted a 12-month clinical trial involving 90 subjects, with an average age of 58, who were RPD users. They observed low plaque indices, which were attributed to education, maintenance of oral hygiene and prostheses, and professional follow-up in both healthy individuals and those with systemic conditions (29,30).

In this study, the type of RPD material was not associated with greater plaque accumulation, despite previous research suggesting a higher risk of oral diseases in acrylic RPD users (29).

Regarding RPD care practices, this study found that individuals with better care practices (e.g., daily cleaning and cleaning frequency of at least twice per day) had lower rates of root caries and active root caries. These findings are consistent with previous studies (26,31), which have linked inadequate oral hygiene measures to plaque accumulation and persistence (26). Failures in hygiene practices may be explained by a lack of knowledge about proper cleaning techniques (26,32).

Nocturnal removal of RPDs did not show a correlation with caries variables in this study. This result is consistent with findings by Turgut-Cankaya, *et al.* (2020), in a Turkish elderly population. Their study suggested that verbal and written recommendations about hygiene practices and habits have a greater impact on maintaining oral health than nocturnal prosthesis removal alone (33).

The results of this study highlight the importance of guiding elderly patients with RPDs, and their caregivers when applicable, in adopting proper oral health practices. Dental professionals should establish individualized care and follow-up plans based on the patient's risk profile (34).

Based on these findings, follow-up studies in the Colombian population are recommended to identify lifestyle factors related to root and coronal caries. Additionally, intervention studies focused on controlling the establishment and progression of dental caries through conservative approaches should be developed.

CONCLUSIONS

In the institutionalized elderly population studied, a significant correlation was identified between RPD care practices and the presence of root caries. These findings underscore the importance of promoting effective oral hygiene practices and implementing tailored care plans to improve oral health outcomes among RPD users.

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Notes

* Original research.

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