

ASSESSMENT OF THE RELATIONSHIP BETWEEN CHARACTERISTICS OF DENTAL FIXED PROSTHETIC RESTORATIONS AND THE HEALTH OF PERIODONTAL TISSUES

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ABSTRACT

Periodontal health is essential before and after a prosthetic restoration. Thus, the most accurate reproduction of the size and shape of dental crowns with that of natural teeth is the key to maintain a normal relationship between the joint and the occlusal relief and to maintain the integrity and health of periodontal tissues. Maintaining the periodontal health of the teeth with prosthetic restorations, with the placement of the margins in contact with the marginal gingival tissue, is a challenge, because the odonto-periodontal unit is constantly affected by microbial flora and the bacterial plaque accumulation can be stimulated by the presence of dental restorations. The objective of the present study was to analyze the effects of fixed dental prostheses on periodontal inflammatory status and hygiene. After ethical approval, patients were clinically examined, their data was recorded and statistically processed. The results showed the existence of significant differences or correlations between the plaque, calculus or gingival indices and the characteristics of dental prosthesis in some situations. In conclusion, the presence of prosthetic restorations could influence the oral hygiene and be associated with periodontal changes.

Keywords: dental prosthesis, periodontal health

INTRODUCTION

Periodontal health is essential before and after a prosthetic restoration. Thus, the most accurate reproduction of the size and shape of dental crowns with that of natural teeth is the key to maintain a normal relationship between the joint and the occlusal relief and to maintain the integrity and health of periodontal tissues.

The interactions between prosthetic restoration and periodontal health must respect biologic width. The values of the biological width can vary at the level of a dental arch depending on the topography of the tooth, but also between the axial faces of the same tooth [1]. As a result of these variations, for a prosthetic restoration, the

size of the biological width must be evaluated individually, for each tooth [2, 3].

Maintaining the periodontal health of the teeth with prosthetic restorations, with the placement of the margins in contact with the marginal gingival tissue, is a challenge, because the odonto-periodontal unit is constantly affected by microbial flora and the bacterial plaque accumulation can be stimulated by the presence of dental restorations [4].

Interaction of the margin of a fixed prosthesis with gingival tissue such as subgingival, equigingival and supragingival, are the possibilities for the placement of crown margins, with each having advantages and disadvantages [5].

The placement of crown margins represents is very important for the integrity of periodontal tissues, remembering the importance of biological width and the maintaining of dental hygiene, preventing the plaque accumulation. There are clinical cases that require subgingival placement of the restoration margins. These include the esthetic needs of the patient or the presence of subgingival carious lesions, subgingival dental fractures, or involvement of the furcation [6]. However, esthetically placement of crown margins is considered biologically undesirable because it is associated with plaque accumulation and gingival inflammation [7].

Thus, the objective of the present study was to analyze the effects of fixed dental prostheses on periodontal inflammatory status and hygiene.

MATERIAL AND METODES

The study group included a total of 80 adult patients aged between 28 and 81 years, addressed between January 2019 and December 2020 to a dental office for various dental complaints. The inclusion criteria were the adult age over 18, the presence of unidental, pluridental, or both prosthetic restorations. Exclusion criteria: smoking, systemic diseases – diabetes, rheumatoid arthritis, cardiovascular and hepatic diseases. Plaque index (IP), calculus index (IT) and the level of gingival inflammation (GI) were quantified and the material (MP) used (metallic-acryl, metallic, metallic-composite, metallic-ceramic, ceramic, zirconia), the longevity of fixed dental restorations (LP) were noted. The type of crown margin placement was considered as equigingival placement (GE), gingival hyperplasia in mm (GH) and gingival retraction in mm (GR). It was noted the number of artificial teeth (AT) and missing teeth (MT). These parameters (Table 1)

were correlated with the type of prosthetic restoration uni/pluridental on maxillary/mandibullary arch and the location of the restoration anterior/posterior on the arch.

The Ethical Comission of University of Medicine and Pharmacy from Craiova approved the study.

The data were statistically analyzed using the GraphPadPrism 9.3.1 (San Diego, CA, USA). The continuous variables were presented as means \pm standard deviation (SD), being verified their normal distribution with Shapiro-Wilk test. Kruskal-Wallis test was performed to evaluate the differences of continuous variables between groups. The categorical variables were presented as number (percentages). Chi-square test was performed to analyze if the distributions of categorical variables differ from each another. Nonparametric Spearman correlations with two-tailed were performed for not normally distributed or ordinal variables. The alpha level is 0.05 (5%).

RESULTS

The demographic analysis of the studied group of patients indicates a mean age of 50.94 ± 13.41 years. The distribution of the study group by age category showed a higher percentage of patients over the age of 50 who presented prosthetic restorations, with more than half being females, only 9 patients (11.3%) were from rural areas.

A dental clinical examination determined the presence of unidental prosthetic restorations for the maxillary arch in 17 patients and for the mandibular arch in 18 of the total number of patients. 55% of cases with pluridental prosthetic restorations were in the maxillary arch and 48.8% in the mandibular arch. Of the 80 patients studied, 10% had both types of restoration (unidental and pluridental) in the maxillary arch and 5% in the mandibular arch.

Characteristics	Total patients (n=80)
Gender	
Females	51(63.75 %)
Males	29 (36.25%)
Provenience	
Urban	71 (88.8%)
Rural	9 (11.3%)
Unidentalprotheticrestoration	
Maxillary arch	17 (21.3%)
Mandibullary arch	18 (22.5%)
Pluridental prosthetic restorations	
Maxillary arch	44 (55%)
Mandibullary arch	39 (48.8%)
Unidental+Pluridental prosthetic restorations	
Maxillary arch	8 (10%)
Mandibullary arch	4 (5%)

Table 1. Patients' characteristics

Unidental prosthetic restoration for the maxillary arch

A moderate and significant correlation was found between the presence of gingival hyperplasia GH and IT ($r=0.397$) (Table 2).

ρ (Spearman coefficient)	GE	GH	GR
IP	0	0.037	0.055
IT	0.042	0.397*	0.109

Table 2. Correlation of IP, IT, and levels of the gingival margin around the prosthetic crown in the maxillary arch, $*p<0.05$

ρ (Spearman coefficient)	MP
IP	0.405*
IT	0.326*
GI	0.503*

Table 3. IP, IT, and GI correlations with material used in unidental prosthesis for the maxillary arch, $*p<0.05$

In regard to the longevity of fixed dental restorations and its association with the presence of gingival inflammation, a moderate significant correlation was found between LP

and GI ($r\text{-value} = 0.561$, $p\text{-value}<0.01$). A weak significant correlation was found between IP and LP ($p\text{-value}=0.238$) and no correlation between IT and PL ($p\text{-value}=0.109$).

value=0.069). Regarding the material used, it was found a moderate and significant correlation between GI and MP (r-value=0.503) and a weak significant correlation between IP or IT and MP . (Table 3). We found a moderate significant positive correlation between MP and GH (r-value=0.554). Significant differences were found between IP of zirconia, ceramic, metallic-ceramic and their types of materials.

A moderate significant correlation was observed between IT and GR (r-value=0.502, $p < 0.05$). By testing the possible correlation between MP for fixed mandibular prosthesis and IP, IT and GI, we found no significance. There was a significant but weak correlation between LP and GR, MP and GR, L and GR (Table 4). There was no correlation between MP and IP, IT or GI after Chi-square calculations were done.

Unidental prosthetic restoration for the mandibular arch

ρ (Spearman coefficient)	GE	GH	GR
L	-0.091	0.059	0.293*
LP	-0.094	-0.118	0.367*
MP	0.025	-0.295	0.396*

Table 4. Correlation between gingival aspect and location, longevity and material used in unidental prosthetic restoration for the mandibular arch. * $p < 0.05$

Pluridental prosthetic restorations for the maxillary arch

There was found no correlations between AT or MT with IP, IT or GI (Table 5). A weak correlation was found between MT and GI in the posterior part of the dental arch (r=0.237, $p < 0.05$).

ρ (Spearman coefficient)	AT	MT
IP	0.002	-0.047
IT	-0.122	-0.092
GI	0.065	0.029

Table 5. Correlation between IP, IT, GI with AT and MT for pluridental prosthetic restorations in the maxillary arch, $p > 0.05$

There were no significant differences for IP, IT according to MP for pluridental prosthetic restorations in the maxillary arch and no differences were found for IP according to LP (p -value=0.124) after Kruskal-Wallis test was value=0.007).

applied. Differences were found for IT (p -value=0.002) or GI (p -value=0.007) according to L.

The analysis of p -value revealed significant correlation of GI and MP (p -

Pluridental prosthetic restorations for the mandibular arch

ρ (Spearman coefficient)	AT	MT	L
IP	-0.142	-0.075	0.314**
IT	-0.185	-0.182	0.208**

GI	-0.131	-0.052	-0.102
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Table 6. Correlation of IP, IT, GI with the number of artificial teeth and missing teeth, distributed according to location

The analysis of the distribution of IP, IT or GI and the longevity of fixed dental restorations revealed no differences after the Kruskal-Wallis test was applied.

There is no correlation between the material used for pluridental prosthetic mandibular restorations and values for IP, IT and GI (p-values > 0.05).

A significant weak correlation was found between the location of restorations and IP or IT (Table 6).

DISCUSSION

The relationship between periodontal health and prosthetic restorations is close and interdependent. Periodontal tissue health is the key to the long-term success of prosthetic restorations [8]. Regarding the initiation of an inflammatory reaction in the periodontium due to the presence of a fixed prosthetic restoration, some studies have shown that its incorrect marginal adaptation is the probable cause [9].

Over the years, an obvious association has been shown between the patient's periodontal health and prosthetic therapy with fixed prostheses in the case of poor oral hygiene, regardless of the type of marginal adaptation of the prosthesis [10]. From a periodontal view point, both supragingival and equigingival margins are well tolerated [11].

Ercoli and Caton showed that dental plaque accumulation and loss of periodontal attachment are related to the type of prosthetic restoration, with the margin located near the junctional epithelium, causing periodontal inflammation and, potentially, gingival retraction. By disrupting the normal distribution of bacterial plaque on the tooth surface, subgingival placement of prosthetic

of the pluridental prosthetic restorations for the mandibular arch, ** p-value < 0.01

restorations maintains poor oral hygiene [12]. In our study, also, the gingival retraction was correlated to the IT, the marginal crown situation favorizing the calculus accumulation. Frequently, the subgingival placement of the crown margin could determine gingival hyperplasia, by favorizing the plaque accumulation and the inflammation of gingiva (13, 14), in our study, GH being correlated with IT in unidental prosthetic restoration for the maxillary arch.

Regarding the longevity of fixed dental restorations and the location of crown margins, Al-Sinaidi et al. conclude that the patient's age and the duration of prosthetic insertion can affect the periodontal health [15]. Our findings also showed a significant correlation between LP and GR for the unidental prosthetic restoration in the mandibular arch but Abduo and Lyons showed no direct connection between periodontal health and the longevity of fixed dental restorations. The same authors arrived to the conclusion that the position of the finish line and the emergence profile of the prosthetic restoration influence gingival response [16]. Our results showed correlations between LP and GI and between LP and IP for the unidental prosthetic restoration in the maxillary arch, highlighting the possible relation between the longevity and the dental hygiene and gingival inflammation.

The gingival condition and oral hygiene are statistically associated with prosthetic construction type uni or pluridental fixed prosthesis, and the material metal or metal-ceramic. A study investigating the oral hygiene and gingival condition in patients with fixed dental prostheses showed a significant difference in IP and GI of the patients wearing a fixed partial denture, whereas not in single

crowns. The same study showed no significant difference in the type of material [17].

Discoloration of the gingival papilla, a dark color around the restoration margin, and gingivitis were the most common complaints among participants after prosthetic therapy with conventionally manufactured metal-ceramic restorations. Meanwhile, when metal-ceramic restorations were produced utilizing CAD/CAM technology, these clinical symptoms were eliminated, which could be attributed to the metallic base's improved margin adaptation. Regarding CAD/CAM restorations, zirconia-based ceramic proved better results in terms of periodontal health, reduced inflammation, and oral hygiene maintenance [18]. Other authors have shown that, there was no difference in gingival inflammation or plaque index depending on the type of material used, and there was a significant difference in plaque index comparing patients who had crowns and patients who received fixed partial prostheses [19]. Other studies have found that dental materials and their properties in relation to the gingiva have been associated with periodontal responses, indicating that they may influence plaque retention [20]. Similar data has been published by other authors, showing associations between the type of prosthesis and the material used with the presence of dental plaque and gingival inflammation [21- 23]. In our study, it was found significant difference between IP of zirconia, ceramic, metallic-ceramic and their types of materials, a moderate and significant correlation between GI and MP and a weak significant correlation between IP or IT and MP for the unilateral prosthetic

restoration in the maxillary arch, while in pluridental prosthetic restorations for the maxillary arch GI was significantly correlated with MP. We also found a moderate significant positive correlation between MP and GH.

Correct marginal placement is important in prosthetic crowns and fixed partial dentures because it affects mechanical qualities, prosthetic restoration integrity and periodontal health. For fixed dental prostheses, to reduce the occurrence of periodontal pathology, plaque control and oral health education programs are required. Furthermore, it has been shown that various forms of fixed dental restorations have an impact on gingival and periodontal health [24]. Adequate periodontal assessment and treatment, appropriate instructions, and motivation in self-performed plaque control, as well as compliance with maintenance protocols, appear to be the most important factors to limit or avoid any potential negative effects on the periodontium caused by fixed prostheses [25]. In our study, the total number of patients were divided in subgroups according to the parameters to be evaluated, with multiple criteria for exclusion, so our batches had a small number of subjects, this being a limitation of this research. Future studies on a larger number of patients, could provide more statistically significant information about the relationship between the presence of fixed dental prosthesis and the oral hygiene and periodontal health.

CONCLUSION

The presence of prosthetic restorations could influence the oral hygiene and be associated with periodontal changes.

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