



ORIGINAL ARTICLE

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Periodontal status of teeth restored with crowns and their contralateral homologues, Valdivia. Chile.

Abstract: Aim: To determine periodontal status of fixed single prostheses (FSP) installed in 2013 at Austral University of Chile, and its contralateral homologue (CH). Methods: A group of patients with FSP installed during 2013, who met the selection criteria and agreed to participate in the study were evaluated. Probing depth, attachment level; bleeding on probing and dental plaque index for each FSP and CH were measured in 2014; biological width invasion was also evaluated. One FSP and one CH were measured per patient, and in 6 sites for each tooth. Results: Seventy-four patients were evaluated. The majority were women (73%); posterior teeth accounted for 63.5%. The majority of participants had history of previous periodontal disease (85.1%), of which 58.7% was Periodontitis. Six of the patients with a history of gingivitis progressed to periodontitis (23.07%); while 100% of patients with no history of periodontal disease maintained their condition. Only 4 of the FSP evaluated showed biological invasion width. Discussion: Similar results were found for FSP and CH teeth with respect to probing depth, clinical attachment level and bleeding on probing. However, a difference in relation to dental plaque index was observed: positive in 58.1% CH and positive in 29.7% FSP. Under the conditions of this study, it is concluded that the periodontal status of teeth with FSP does not differ from CH.

Keywords: *Periodontal Diseases, Crowns, Dental Plaque Index.*

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INTRODUCTION.

When performing a fixed single prosthesis (FSP) is essential for the gingival tissue to be healthy, however, once the rehabilitation period is over, the evolution of the periodontal condition is unknown¹.

Nart *et al.*², Ababneh *et al.*³ and Passariello *et al.*⁴ agree that a fixed prosthesis with defective margins creates plaque-retentive areas that produce inflammation, insertion and bone loss, being highly associated with periodontal destruction⁵. It also alters the subgingival microflora contributing to anaerobic bacteria proliferation associated with chronic periodontitis. Moreover, Müller⁵ determined that periodontally treated and prosthetically

rehabilitated patients are associated with an increased risk of tooth loss compared to patients without prosthetic treatment, suggesting that fixed prosthesis would itself become a risk for periodontal disease. Behr *et al.*⁶ agreed with the aforementioned statements, and further concluded that tooth loss in this case is directly related to the age of patients.

Periodontal condition of patients, as reported by Loi *et al.*⁷ will be affected when there are deficiencies in the FSP, which may result in an apical migration of tissue, potentially leading to unsatisfactory aesthetics.

Plaque index, gingival index and calculus index, probing depth and tooth mobility of pillar teeth in remova-

ble partial denture were evaluated in another study. Results showed no significant differences between natural pillar teeth and pillar teeth with fixed single prosthesis^{8,9}. However, it is still necessary to evaluate the periodontal condition of patients who were rehabilitated using only FSP, without using pillar teeth in a removable denture, in order to determine the evolution of the periodontal area that was healthy and stabilized during rehabilitation, since there is no certainty whether the fixed prosthesis is a periodontal risk by itself, or only in those cases where no optimum adjustment has been achieved. Therefore, we expect this paper could become the first step to further clarify this question in a prospective study.

The aim of this study was to determine the periodontal condition of the teeth rehabilitated using fixed single prosthesis (FSP) and their contralateral homologues (CH) in treatments performed in 2013 at Universidad Austral de Chile.

MATERIALS AND METHODS.

This cross-sectional study was conducted in 2014. Its target population was patients rehabilitated with FSP during 2013. The study was approved by the Universidad Austral de Chile Research Ethics Committee.

Rehabilitated patients with peripheral FSP¹⁰ were included in the study. They were treated at Clínica Integral del Adulto of the School of Dentistry at Universidad Austral de Chile in 2013. Patients were periodontally healthy or stabilized at the time of rehabilitation, and had CH. Patients rehabilitated with fixed plural prosthesis (FPP) rather than single prosthesis (FSP) were excluded. Patients with CH treated with FSP, FPP or restoration in relation to the gum, diagnosed with diabetes mellitus, or with aggressive periodontitis, pregnant, and daily smokers (defined as those who smoke more than seven cigarettes a week¹¹) were also excluded from the study.

A training period, supervised by an expert, was performed. In that period, a sample corresponding to 10% of all patients, (*i.e.* approximately 8 patients) that would participate in the study, was assessed in order to determine in-

tra- and interobserver agreement by calculating the Kappa index. The training period was performed at the Dental Clinic of Universidad Austral de Chile and the Kappa index obtained by observers was 0.8. Patients assessed during the training period were not included in the final sample.

At a first stage, a review of dental records was conducted in order to recruit the patients who met the selection criteria. Subjects were contacted by telephone and asked about their intention to collaborate in the study, coordinating a date and time for their evaluation. At a second stage, prior to conducting the assessment, patients were requested to sign the informed consent. Then researchers made sure that patients met the selection criteria, thus confirming the inclusion of the patient in the study and proceeding to make the corresponding assessments. A tooth with FSP and HC was assessed in each patient.

To classify the periodontal condition of patients before receiving rehabilitation in 2013, three general categories were considered: health, gingivitis or periodontitis. In this context, health meant a lack of periodontal disease; while plaque-induced gingivitis involved an inflammation of the tissues without loss of connective tissue attachment¹². Likewise, periodontitis was considered as a chronic inflammation caused by an infection of periodontal tissues, with a probing depth greater than 4mm and with a clinical attachment loss equal to or greater than 1mm measured with a North Carolina periodontal probe (Hu-Friedy, USA). These same categories were used to determine the transition from one state to another, *i.e.*, from health to gingivitis or periodontitis; or progression from gingivitis to periodontitis¹⁴.

The unit of study was the patient rehabilitated with FSP, defined as extracoronary cemented restoration covering the entire outer surface of the clinical crown¹⁰; and its CH, defined as the tooth opposite to the rehabilitated tooth with respect to its relative position in the arch and its function. If the patient had more than one FSP that met the selection criteria, only one of them was evaluated, giving priority to those that were in a more anterior position in the dental arch. Also if both teeth belonged to the same dental group,

the first tooth of each group was chosen.

The teeth were divided into 6 sites to assess (mesial vestibular, vestibular, distal vestibular, mesial palatine or lingual, palatine or lingual and distal palatine or lingual)¹⁵, a value for each parameter was assigned. The measurement was carried out by two non-expert reviewers (SL and MO), previously trained in sessions of up to 30 minutes per patient. The following parameters were measured with a North Carolina periodontal probe (Hu-Friedy, USA):

- Position of free gingiva or gingival retraction, *i.e.*, the distance from the cemento-enamel juncture to the gingival margin, measured in millimeters¹⁵;

- Probing depth, *i.e.*, distance from the gingival margin to the base of the gingival sulcus or periodontal pocket, measured in millimeters¹³;

- Clinical attachment level, *i.e.*, distance from the cemento-enamel juncture to the bottom of the periodontal pocket¹³. This parameter was measured using the following formula: probing depth minus free gingival position measured in millimeters; invasion of the biological width, considered valid when termination of FSP was introduced more than one millimeter in the gingival sulcus and clinical signs of inflammation were observed¹⁶;

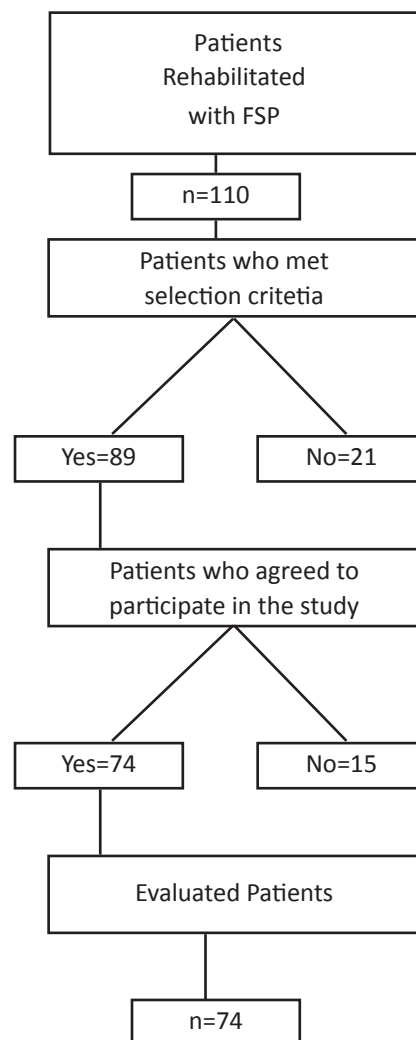
- Bleeding on probing: sign observed on the bleeding tooth surfaces up to 20 seconds after using the periodontal probe¹⁵ on the gingival margin;

- Plaque index, measured by visual inspection after application of a drop of Caristop Dual Tone (liquid developer) on each tooth, was considered positive when plaque was observed in relation to the gum; following the indications described by O'Leary Index¹⁷.

If any type of treatment failure was detected while assessing, it was communicated to the patient in order to find an appropriate solution. Furthermore, in all cases the patient was informed about his/her periodontal condition and his/her need for treatment.

The data obtained was recorded by examiners in a specially designed notepad. A single numbered notepad was used to record the data from each unit of study. The data recorded included the abovementioned parameters and the

Figure 1. Patient Selection Diagram.



presence of pre-existing periodontal disease (confirmed in the medical record) in relation to health, gingivitis or periodontitis. The patient's sex, age and tooth to be evaluated were also registered.

Subsequently, data was entered into a Google Drive spreadsheet (Google, California, USA) by both examiners the same day it was collected. Data was then tabulated using SPSS Statistics 22 (IBM, Chicago, USA). An average of the 6 measurements per tooth was obtained, generating a single value for each parameter. Bleeding index and plaque index were considered positive for the tooth when 3 or more positive values were obtained.

Results were analyzed using descriptive statistics for both FSP and CH, parameters considered were: average

Table 1. Characterization of participants by age.

	N (%)	
Sex	Female	54 (73%)
	Male	20 (27%)
Age range	Under 20 years	1 (1.35%)
	20-40 years	26 (33.14%)
	40-60 years	37 (50%)
	60-80 years	10 (13.51%)
	Older than 80 years	0 (0%)
Previous periodontal condition	Healthy	11 (14.86%)
	Gingivitis	26 (35.13%)
	Periodontitis	37 (50%)

Table 2. Probing depth and Clinical Attachment Level of FSP and CH. (SD)=Standard deviation.

	Probing depth (in millimeters)	Clinical attachment level (in millimeters)
	Mean (SD)	Mean (SD)
FSP	2.09 (0.4)	1.49 (0.7)
CH	2.13 (0.4)	1.63 (0.7)

Table 3. Bleeding on probing Positive and Plaque Index Positive in FSP and CH.

	Bleeding on probing Positive		Plaque Index Positive	
	Frequency	Percentage	Frequency	Percentage
FSP	16	21.6%	22	29.7%
CH	15	20.3%	43	58.1%

probing depth and clinical attachment loss, frequency of positive bleeding on probing, frequency of teeth with poor hygiene, frequency of invasion of the biological width, and frequency of teeth affected with pre-existing periodontal disease, differentiating whether it corresponded to gingivitis or periodontitis. The parameter gingival position was only measured to calculate the level of insertion.

If the measurement of any of these parameters had not been made or if data obtained was confusing or erroneous, all the data belonging to that unit of study was discarded.

RESULTS.

A sample of 74 patients (Figure 1), of which 73% were women, was evaluated. Their sociodemographic characterization is shown in Table 1. Of 74 FSP evaluated, 27 (36.5%) were in anterior teeth, and 47 (63.5%) in posterior teeth. 85.1% (N=63) of the patients had a previous

history of periodontal disease, of them 26 were diagnosed with gingivitis and 37 with periodontitis. Among patients with a history of gingivitis, 6 progressed to periodontitis (23.07%); while 100% of patients with no history of periodontal remained in that condition. Only 4 of the evaluated FSP showed biological width invasion. The results of probing depth, clinical attachment level, bleeding on probing and plaque index are shown in Tables 2 and 3. Only 5 teeth with FSP had periodontal pocket (probing depth greater than 4mm), and 8 in the case of CH.

DISCUSSION.

In relation to the parameters assessed as indicators of periodontal disease, no differences between teeth with FSP and CH were found for the following variables: probing depth, clinical attachment level and bleeding on probing.

However, there were differences regarding plaque index,

which was positive in 58.1% of CH and in 29.7% of teeth restored with FSP. These findings differ from those found by Valderhaug *et al.*¹⁸, in which both groups got 21% of visible surfaces with plaque. This could be explained by the fact that in this last study assessment was performed on teeth with FPP. So, according to our findings, it can be said that a successfully performed FSP, instead of accumulating more plaque, shows a better index of hygiene, since patients reported to maintain a better oral care in teeth that have been previously treated. This is in line with findings reported by Ababneh *et al.*³

Bleeding on probing was positive for 21.6% of teeth restored with FSP, a similar result to that 25% reported by Nápänkanga *et al.*¹⁹ However, this result differs from data reported by Bustos & Oyanaderl, in which there was a 77% difference. The reason for this difference may be related to the number of years that had passed since their patients had been rehabilitated with FSP, involving external factors, for example, motivation and level of commitment of the patients to maintain a proper oral hygiene.

Probing depth averaged 2.09mm for FSP and 2.13mm for CH, resulting in a difference of 0.04 mm between FSP and CH; higher in the control group. The average value for FSP is similar to that reported by Ababneh *et al.*³, in which probing depth was 2.01mm. However, it differs from the values found by Ardila²⁰, in which probing depth was 0.5mm higher in the group with fixed prosthetic restorations. These differences can be explained due to the wide range of studies and publications included in the research done by Ardila²⁰, and to the length of the follow-up study, that was 15 years after patients have been rehabilitated.

Regarding loss of attachment (CAL), an IL of 0.78mm in the experimental group and 0.57mm in controls was observed in the study performed by Schätzle *et al.*²¹. Their results are similar to the values found in this study, in which CAL in teeth with FSP was 1.49mm and 1.63mm for CH. Although these values are greater than those reported by Schätzle *et al.*²¹, they do not show a significant difference between the groups.

Schätzle *et al.*²¹, in their 26-year longitudinal study,

concluded that the degree of inflammation of the gingiva adjacent to subgingival restorations was higher than those without restoration or with restorations of 1mm above the gingival margin. Valderhaug *et al.*¹⁸ reported that the incidence of bleeding on probing was higher when the crown margins were positioned subgingivally. Because there are numerous studies reporting the influence of different cervical endings in the fixed periodontal prosthesis, and that this observation does not constitute a contribution to the objective of this study, this factor was not considered as an assessment parameter.

Since data from dental records of unknown accuracy and reliability was used in this study, all parameters that are maintained over time (persistence of FSP and CH) were corroborated. However information about pre-existing periodontal disease and type of diagnosis was assumed to be accurate and reliable. No sampling techniques were performed and all patients who met the selection criteria and agreed to participate in the study were evaluated; this in order to increase sample size. In addition, because there was an estimated average for each quantitative variable, it is likely that the result regarding healthy sites was underestimated, however it is the most representative value that can be used. Finally, being this a cross-sectional study, it is not possible to establish causal relationship between the variables studied.

Taking into account the aspects described above, we suggest to perform analytical and prospective studies. Although in this study results were similar regarding periodontal condition of teeth restored using FSP with respect to their CH, the possibility of a link between FSP and periodontal disease cannot be ruled out due to the limitations of the study design. In addition, it would be advisable to assess long-term placed FSPs. In fact, it would be convenient to reassess the same sample used in this study in over five years.

Under the conditions of this study, we concluded that the periodontal condition of the teeth rehabilitated with fixed single prostheses do not differ from their contralateral homologous teeth.

Estado periodontal de dientes rehabilitados con prótesis fija unitaria y sus homólogos contralaterales, Valdivia - Chile.

Resumen: Objetivo: Determinar el estado periodontal de los dientes rehabilitados con prótesis fija unitaria (PFU) realizadas el año 2013 en Universidad Austral de Chile, y la de su homólogo contralateral (HCL). Material y método: Se evaluaron los pacientes con PFU realizadas durante el 2013 que cumplieron con los criterios de selección y aceptaron participar. Se midió durante el año 2014: profundidad al sondaje, nivel de inserción, sangramiento al sondaje e índice de placa para cada PFU y HCL; y se consignó invasión del ancho biológico. Se midió una PFU y un HCL por cada paciente, y 6 sitios por cada diente. Se utilizó estadística descriptiva. Resultados: Se evaluaron 74 pacientes de los cuales 73% fueron mujeres. El 63,5% de los dientes evaluados fueron

posteriores. El 85,1% tenía antecedentes de enfermedad periodontal previa, de los cuales el 58,7% correspondió a Periodontitis. De los pacientes con antecedentes de gingivitis, 6 progresaron a periodontitis (23,07%); mientras que el 100% de los pacientes sin antecedentes de enfermedad periodontal mantuvieron su condición. Sólo 4 de las PFU evaluadas tenían Invasión del ancho biológico. Discusión: Se encontraron resultados similares entre PFU y HCL para las variables profundidad al sondaje, nivel de inserción clínica y sangramiento al sondaje. Sin embargo, hubo diferencias en índice de placa, positivo en un 58,1% de los HCL y en un 29,7%, de las PFU. Bajo las condiciones del presente estudio se concluye que el estado periodontal de los dientes rehabilitados con PFU no difiere del estado de los HCL.

Palabras clave: *Enfermedad periodontal, Corona, Índice de Placa Dental.*

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