

## A Limited and Useful Approach to Determine Proximal Periodontal Health

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### ABSTRACT

*Previous researchers have shown that there exists an interaction between gingival blood flow and gingival health. The purpose of this study was to compare the papillary blood flow at sites treated by a bridge with the blood flow at untreated sites. Twenty persons with resin-bonded fixed partial dentures were included in the study. The contralateral natural teeth of the site symmetrical to that of the restorations were used as controls. Blood flow was measured from the middle point of the papillae from both test and control sites by Laser Doppler Flowmetry (LDF). The plaque index, papillary bleeding index and probing depth measurements were recorded. There was a statistically significant difference between the test and control sites in papillary blood flow measurements and clinical indices ( $p < 0.05$ ). Moreover, there was statistical significance between gingival blood flow measurements and papillary bleeding index in the experimental group ( $p < 0.05$ ).*

*In short, there exists an important relationship between resin-bonded fixed partial dentures and papillary blood flow. Although there were no correlations between LDF values and clinical parameters, it can be emphasized, within the limits of the study, that LDF readings have limited diagnostic value, at least when it comes to clinical performance of fixed prosthesis.*

**Keywords:** Fixed partial dentures, Laser Doppler Flowmetry, papillary blood flow

## Un Enfoque Limitado y útil para Determinar la Salud Proximal Periodontal

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### RESUMEN

*Investigadores anteriores han mostrado que existe una interacción entre el flujo de sangre gingival y la salud gingival. El propósito de este estudio fue comparar el flujo de sangre papilar en los sitios tratado por un puente, con el flujo de la sangre en los sitios no tratados. Veinte personas con prótesis dental parcial fija adherida con resina fueron incluidas en el estudio. Los dientes naturales contralaterales del sitio simétrico al de las restauraciones, se usaron como controles. El flujo de sangre se midió a partir del punto medio de las papilas de los sitios de prueba y de control, usando un medidor de flujo mediante Láser Doppler (LDF). Se registraron el índice de la placa, el índice de sangramiento papilar, y las mediciones para el examen de la profundidad. Hubo una diferencia estadísticamente significativa entre los sitios de la prueba y los de control en las mediciones del flujo de sangre papilar y los índices clínicos ( $p < 0.05$ ). Más aún: hubo una diferencia estadísticamente significativa entre las mediciones del flujo de sangre gingival y el índice de sangramiento papilar en el grupo del experimento ( $p < 0.05$ ). En resumen, existe una relación importante entre la prótesis dental parcial fija adherida con resina y el flujo de sangre papilar. Aunque no había ninguna correlación entre los valores de LDF y los parámetros clínicos, puede subrayarse – dentro de los límites del estudio – que las lecturas de LDF*

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*tienen un valor diagnóstico limitado, al menos cuando se trata del funcionamiento clínico de la prótesis fija.*

**Palabras claves:** Prótesis dental parcial fija, medidor de flujo mediante Láser Doppler (LDF), flujo de sangre papilar

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## INTRODUCTION

Previous studies have shown that dental restorations and periodontal health are inseparably interrelated. It is well accepted that the adaptations of the margins, contours of the restoration, proximal relationships and surface smoothness have critical biologic impact on the gingiva and supporting periodontal tissues (1, 2, 3). Prosthodontics can alter the surface continuity and the relationship of the restored tooth with the adjacent teeth, contralateral teeth and the supporting periodontal tissues (4). There are significant points controlling the effects of restorations on gingival health in the localization of the crown margin relative to the gingival margin (5, 6).

After the effects of various factors, gingival inflammation results in increased vascularity with more capillary loops, larger vessel size and slower blood flow and a restriction of the afferent blood vessels. Inflammation-induced vasculitis and vascular permeability allow lymphocytes and serum substances to leak into the connective tissue and can lead to an immune response resulting in tissue destruction (7).

The aim of the present study was: **1.** to compare papillary blood flow values at the site treated by fixed bridges with the contralateral untreated site papillary blood flow measurements, and **2.** to explore whether there are any relationships between blood flow values and clinical indices used.

## SUBJECTS AND METHODS

These studies involved 20 persons (10 females and 10 males) aged 22 to 55 (mean 34.42) years who have visited the Faculty of Dentistry and Department of Prosthodontics at Cumhuriyet University. Patients were enrolled in the research after their informed consents are taken. Persons having gingivitis, periodontitis and any systemic problems (eg, diabetes, cardiovascular disorders), smokers and those having had any antibiotic and other medicament treatment were excluded from the study.

In the first step, all study participants with tooth 46 missing in their mouth were treated by a resin-faced bridge placed subgingivally 0.5 mm in depth and between the right second premolar and second molar teeth of the mandible. The related first molar teeth were lost due to caries and endodontic lesions. Cr-Ni dental casting alloy Phase-N (Unitex, France) and the veneering material Biodent (Dentsply, USA) were used in the fabrication of resin-faced fixed partial dentures. All of the fixed prostheses had ridge-lap pontics. Veneering materials were polymerized in Ivomat IP3 (Ivoclar

Vivadent, Austria) and the prostheses were cemented using Adhesor Carbofine (Spofa Dental, Praha) zinc polycarboxylate cement. All participants were advised to brush their teeth and do interdental cleaning until the end of the 6<sup>th</sup> month.

Blood flow measurements were taken 6 months after the prosthodontic treatment with a Laser Doppler Flowmetry (LDF) apparatus (Periflux 4001 Master, Perimed AB, Sweden) from midpoint of the vestibular aspect of each papillae located between the second premolar (crowned)-first premolar and second molar (crowned)-third molar region at the test site. In the control site, measurements were taken from the same papillae of the contralateral natural teeth of the mandible. The LDF emitted light with a 780 nm wavelength. Band width was 20 Hz-20 kHz, with a sampling frequency of 32 Hz. The diameter of the probe used was 1 mm (415-159, Perimed, Sweden). The calibration was done with the "PF 1000 Calibration Device" (Perimed, Sweden) before each blood flow record.

An acrylic splint (Ortocryl 2000, Dentaurum, Germany) was made to position the probe labially on the crown. Before the blood flow measurements, all patients waited 15 minutes. Thus, 40 papillae from both test and control sites were assessed. Mean perfusion units (PU) were found using at least 30-s of recording. In addition to the measurements, the papillary bleeding index (PBI) [8], plaque index (PI) [9] and probing depth (PD) were also recorded to determine papillary health. Data were analysed using Mann Whitney U test and correlation analysis;  $p$  values  $< 0.05$  were considered statistically significant.

## RESULTS

Plaque index, papillary bleeding index, probing depth and blood flow mean  $\pm$  SD values for the test and control sides and relations between these measurements are shown in Table 1. A statistically significant difference was found between the test and control sites, clinical indices and GBF ( $p < 0.05$ ; Table 1). Moreover, there were no significant correlations between the clinical indices and papillary blood flow measurements at both the study and control sites ( $p > 0.05$ ), except the experimental group GBF and PBI ( $r = -0.55$ ,  $p > 0.05$ ).

## DISCUSSION

The present study emphasizes the importance of papillary blood flow proved by using Laser Doppler Flowmetry, a non-invasive method. The abutment teeth and the dental material used in the restoration merit the most attention. Nevertheless, the periodontal therapy performed, and mistakes in

Table 1: Plaque index, papillary bleeding index (PBI), probing depth and papillary blood flow (mean  $\pm$  SD values) from test and control sites and statistical comparison of these measurements

Site	Plaque Index (PI)	Papillary Bleeding Index (PBI)	Probing Depth (mm)	Papillary Blood Flow (PU)
test	1.87 $\pm$ 0.58°	2.20 $\pm$ 0.57°	3.23 $\pm$ 0.66°	82.51 $\pm$ 11.69***
control	1.52 $\pm$ 0.59	1.55 $\pm$ 0.41	1.82 $\pm$ 0.35	29.47 $\pm$ 7.12

\*\*\*  $p < 0.05$  compared to test site PBI, °  $p < 0.05$  compared to control site value

tooth preparation, impression, temporary crown restoration and other steps will negatively affect periodontal tissues (10).

Several researchers have shown that subgingival margins caused much more gingival inflammation than do supragingival margins (11–14). Renggli *et al* (12), in a case control study, reported that subgingival margins cause gingival inflammation. From this point of view, in our study, margins were positioned subgingivally 0.5 mm in depth, which was suggested to be the most acceptable value.

Laser Doppler Flowmetry has been used in several studies in medicine and dentistry. Different agents and allergens can alter blood flow in the gingiva (14–16). Matheny *et al* (17) reported that blood flow can be measured non-invasively by LDF. They measured both the movement of red blood cells and the blood flow in capillary vessels in a small amount of tissue.

Vag *et al* (18) studied the effects of the crown margin on gingival health and emphasized that the LDF technique is a noninvasive way to monitor blood flow in tissues. They compared the results of the measurements before restoration, at cementation and after therapy and they found a correlation between the gingival index and blood flow results.

In this study, we compared the clinical indices of papillae and papillary blood flow readings between the retainers and the symmetric teeth in the same jaw. There was a statistically significant difference in papillary blood flow measurements between the test and control sites ( $p < 0.05$ ). High blood flow values of the test side can depend on the subgingival position of the margins and the effect of resin material that may lead to more plaque accumulation. Moreover, the degree of interproximal cleaning level should be considered. As seen in Table 1, at the study sites, the plaque index and papillary bleeding index values were also higher than at the control sites. However, there was no statistically significant difference between the respective clinical indices records (Table 1). The difference can be attributed to the susceptibility to plaque on the resin-bonded bridges in the test site. On the other hand, the blood flow values in the control site are affected also from the plaque accumulation and it could be accepted that these values are greater than blood flow measurements of the healthy gingiva.

In the present study, there was a significant correlation between GBF and PBI in the study group and this result is comparable with previous studies (Table 1). A relationship

between increased blood flow values and gingival index might be assumed, in particular, when the changes are started due to plaque induced periodontal disease as shown previously (18).

Kerdvongbundit *et al* (19) demonstrated that inflammation alters the microcirculatory and micromorphological dynamics of human gingiva and that LDF was useful for monitoring. Parallel to this fact, Develioglu *et al* (20) has reported a result similar to our findings in a study suggesting that marginal gingival health can be affected by the subgingivally located resin-bonded fixed bridges. Findings in the present study support these conclusions.

In summary, the study demonstrates that resin-bonded fixed partial dentures alter gingival blood flow. Although there are no correlations between LDF values and clinical parameters, it can be emphasized, within the limits of the study, that LDF readings have limited diagnostic values, at least when it comes to clinical performance of fixed prosthesis. Moreover, blood flow measurements may yield valuable information about inflamed gingiva.

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