

PERI-IMPLANT CREVICULAR FLUID VOLUME IN DENTAL IMPLANT RECALL PATIENTS AT KING SAUD UNIVERSITY

*SAMEER A. MOKEEM, BDS, MS, PhD

ABSTRACT

It is generally accepted that peri-implantitis is caused by a bacterial challenge to the implant-bearing soft and hard tissues. A few studies have focused on the investigation of peri-implant crevicular fluid (PICF) flow rate and their relationship with the peri-implant condition. Hence, the aim of the present study was to assess if PICF flow rate can be further studied as a possible objective diagnostic aid in dental implants. 63 implant fixtures from 30 systemically healthy subjects were divided into 2 groups, 28 implants with probing depth <3mm (GROUP I) and 35 implants with probing depth ≥3mm (GROUP II). Plaque Index and probing depth were evaluated for each implant. The volume of collected peri-implant crevicular fluid was measured with Periotron[®] 6000. Implants with deep probing depth (≥3mm) had significantly higher scores of plaque indexes and higher mean of PICF volume (1.91 ±1.01 and 0.314 ±0.097 μ/L, respectively) (P < .01). The present results suggest that PICF analysis could be a useful quantitative parameter for peri-implant gingival changes.

Key words: *Crevicular fluid, osseointegrated implant, plaque Index, probing depth*

INTRODUCTION

The introduction of osseointegrated implants in the daily dental practice greatly increased the practitioner's capability of effectively restoring a patient's dentition in both fully and partially edentulous subjects¹. Despite reported high success rates, failures during healing phase of dental implants still occur. Implant failure can be distinguished on the basis of chronological criterion as early failures, occurring within weeks to a few months after placement, and late failures, which occur later; these different kinds of failures develop from different etiologies². This situation can be explained by the fact that parameters used to assess implant failure frequently represent the evaluation criteria with which different dental specialists are most familiar^{3,4}. In the literature, clinical periodontal parameters have been widely used to monitor the conditions of endosseous implants; however, a general agreement on the significance of such parameters (i.e., periodontal probing; bleed-

ing tendency) around dental implants still does not exist⁵.

The biological constituents of gingival crevicular fluid (GCF) have been studied with the aim of objectively diagnosing, predicting, and monitoring periodontal disease activity⁶. GCF, in fact, contains products derived from microbial plaque, tissue breakdown, host cells, and host immunity that, in some instances, have been demonstrated to be related to the active phases of periodontal destruction⁷. The peri-implant gingival sulcus has been shown to be similar to the periodontal crevice with respect to gingival fluid flow^{3,8}. In spite of this observation, only a few studies have focused on the investigation of peri-implant crevicular fluid (PICF) components and their relationship with the peri-implant condition.

The transmucosal abutment of osseointegrated dental implants serves as a surface for bacterial colonization of microbial biofilms. Like the gingival crevice

***Correspondence:** Dr. Sameer A. Mokeem, Assistant Professor, Department of Preventive Dental Sciences, College of Dentistry, King Saud University, P.O. Box: 60169, Riyadh 11454, Saudi Arabia. E mail: smokeem@ksu.edu.sa

around the natural tooth, the peri-implant mucosa covering the alveolar bone is closely adapted to the osseointegrated implant and forms a sulcus coronal to the supporting bone. The opportunity for microbial colonization and thus provoking an inflammatory reaction, possibly leading to tissue destruction, might be analogue with the key events in the pathogenesis of periodontitis. According to Esposito *et al*², biological failures can be divided into early and late non-infectious (overload) or infectious peri-implantitis.

To date, only a limited number of studies are available concerning the flow rate of peri-implant crevicular fluid and its relation with the health or diseased status of the implant. Therefore, the aim of the present study was to investigate the levels of peri-implant crevicular fluid volume and its relation to plaque index and periodontal pocket.

MATERIALS AND METHODS

The study sample consisted of 63 loaded dental implants (ITI system, Strauman Institute AG, Waldenburg, Switzerland) from 30 recall patients (19 male and 11 female) who had under-gone more than 1 year of prosthetic reconstruction. Patient ages ranged from 22 to 61 years old, with a mean of 44.6 years.

Plaque Index⁹, and probing depth (measured at four points around the implants) were recorded for each implant. One clinical examiner performed all the clinical measurements. Calibration exercises for probing measurements were performed in five patients before the actual study. The examined implants were grouped into two based on the probing depth. The first group had a probing depth of < 3mm and the second group with a probing depth of ≥ 3mm.

Peri-implant Crevicular Fluid (PICF)

The peri-implant gingiva was gently dried with an air syringe. Thirty seconds later, a sterile dry filter paper strip (Periopaper^a, Pro Flow, Amityville, NY, USA) was inserted until minimum resistance is felt (intra-crevicular technique) for 3 seconds to empty the crevicular pool; this filter strip was removed and discarded. After 27 seconds, another sterile dry filter paper strip was placed at the sulcus orifice for three seconds, with the total elapsed time being 30 seconds¹⁰.

Strips macroscopically contaminated with blood or saliva was discarded. The volume of collected fluid was measured with a Periotron System (Periotron^a 6000, Harco Electronics Ltd., USA). Before each measurement, the instrument was calibrated, using saline administered with a Hamilton syringe. With the switch on the no hold mode, the highest numerical readings were recorded. The digital numerical values were converted to fluid volume by dividing the reading by 200¹⁰.

Data analyses

Statistical analysis of data was per-formed with GraphPad InStat[®] software (GraphPad Software, San Diego California USA, www.graphpad.com). Mean and standard deviation scores were calculated for plaque index (PI), probing depth (PD), and peri-implant crevicular fluid (PICF) volume. The mean differences of PICF volume, plaque index, and probing depth between the two study groups were statistically analyzed using unpaired *t*-test. P-values <0.05 were considered significant.

RESULTS

The study findings are presented in table 1. There were 28 implants in group I (PD < 3mm) and 35 in group II (PD ≥ 3mm). The mean plaque index among group I and II were between score 1-2 according to the criteria of Loe & Silness [9]. The score of plaque index among group I was 1.43 ±0.84, and that for group II was 1.91 ±1.01. The probing depth of group I was 2.43 ±0.36mm, and that of group II was 3.68 ±0.28 mm. The mean of

TABLE 1: THE PLAQUE INDEX (PI), PROBING DEPTH (PD), AND PERI-IMPLANT CREVICULAR FLUID (PICF) AMONG GROUP I AND GROUP II

	N	PI (mean ± SD)	PD (mm) (mean ± SD)	PICF (µL) (mean ± SD)
GROUP I (Implant with PD < 3mm)	28	1.43 ±0.84	2.43 ±0.36	0.271 ±0.063
GROUP II (Implant with PD ≥ 3mm)	35	1.91* ±1.01	3.68* ±0.28	0.314* ±0.097

* P-value < .01

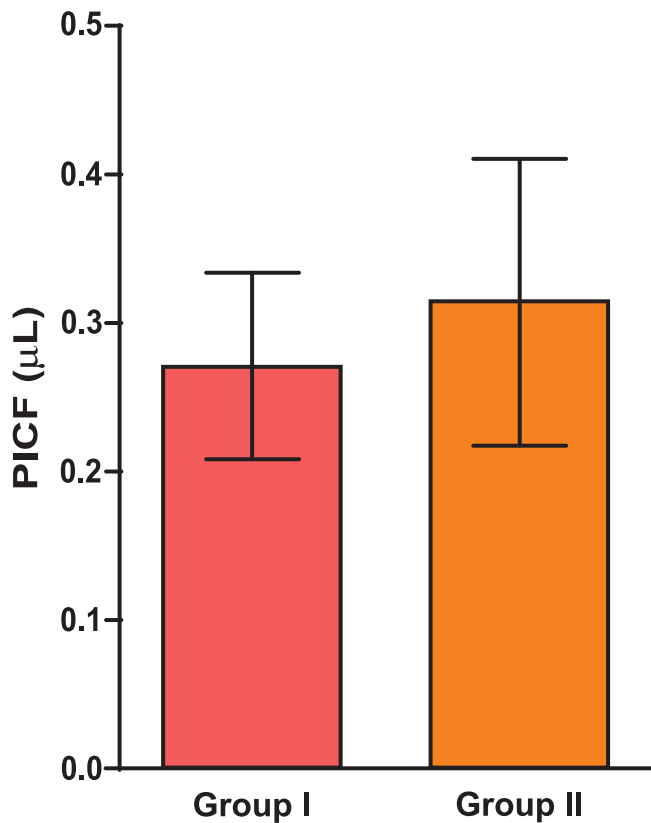


Fig 1: The peri-implant crevicular fluid (PICF) in group I and group II subjects

GCF volume of dental implants with probing depth < 3mm (group I) was $0.271 \pm 0.063 \mu\text{L}$, while those of probing depth $\geq 3\text{mm}$ (group II) was $0.314 \pm 0.097 \mu\text{L}$. These differences for the peri-implant crevicular fluid (PICF) volume, the Plaque Indexes, and the probing depths between the group I and group II were statistically significant ($P < .01$). Implants with deep probing depth ($\geq 3\text{mm}$) had significantly higher scores of plaque indexes and higher mean of PICF volume (Figure I)

DISCUSSION

The peri-implant gingival sulcus has been shown to be similar to the periodontal crevice with respect to gingival fluid flow¹¹. Peri-implant crevicular fluid has been studied with the aim of objectively diagnosing, predicting, and monitoring the peri-implant condition³.

This study was designed to evaluate the relationship between the peri-implant crevicular fluid (PICF) volume around osseointegrated implants and peri-implant condition. The PICF volume in group II (PD

$\geq 3\text{mm}$) was much higher than that in group I (PD < 3mm). In addition, the group with a higher Plaque Index had higher crevicular fluid volume than that with a lower Plaque Index. This result suggests a close relationship between crevicular fluid volume and gingival inflammation around the implants, which conflicts with reported results involving periodontal tissues^{2,12}. These observations agree with the biological assumption. In fact, GCF from healthy periodontal tissues, and that the peri-implant marginal tissues have been shown to be similar to periodontal tissues with respect to many anatomical and physiological characteristics³. Among them, gingival fluid flow presents analogies between peri-implant and periodontal structures^{2,5}. This observation may suggest that PICF analysis could represent a suitable diagnostic strategy in the evaluation of dental implants. Hence peri-implant crevicular fluid analysis may help in detecting early metabolic and biochemical lesions not readily discernible, as well as in monitoring the osseointegration process and the bone response to occlusal loading, thereby improving the long-term success of implants¹³.

CONCLUSION

From the findings of this investigation, it appears that crevicular fluid volume around osseointegrated implants could be a useful quantitative parameter for peri-implant gingival inflammation, and it reflects the accumulation of plaque around the implants.

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