

CLINICAL AND RADIOLOGICAL STUDY ON PERI-IMPLANT STATUS IN POSTERIOR IMPLANT-SUPPORTED PARTIAL FIXED DENTURES

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CLINICAL AND RADIOLOGICAL STUDY ON PERI-IMPLANT STATUS IN POSTERIOR IMPLANT-SUPPORTED PARTIAL FIXED DENTURES (Abstract). **Aim** of this study was to evaluate the clinical and radiological status of the peri-implant tissues in patients treated with posterior implant-supported partial fixed dentures. **Materials and methods:** The retrospective research was conducted on a cohort of 48 patients (mean age 63.04 ± 10.723 years). The study group included patients with posterior edentulism treated by implant-supported metal-ceramic fixed prosthetic restorations. Socio-demographic data (gender, age group) and anamnestic data were collected on: smoking status; periodontal grade; compliance to the supportive periodontal/peri-implant therapy; OHI index. Clinical and radiological parameters were assessed for 166 implants to establish the status of the peri-implant tissues and prevalence of peri-implantitis. **Results:** 45.8% of patients and 19.9% of implants were diagnosed with peri-implantitis. Significant statistical differences were found between implants without peri-implantitis and implants with peri-implantitis for gender ($p=0.022^*$), age group ($p=0.018^*$), smoking status ($p=0.007^{**}$), OHI index ($p < 0.001^{**}$), periodontitis stage ($p < 0.001^{**}$), and compliance to periodontal/peri-implant support therapy ($p < 0.001^*$). **Conclusions:** Although peri-implantitis affects almost half of the patients (45.8%), the proportion of individual implants affected is lower (19.9%). Incidence of peri-implantitis was significantly lower to patients with good oral hygiene, non-smokers, low grade periodontal disease, or patients compliant with periodontal/peri-implant support therapy. **Keywords:** POSTERIOR EDENTULISM, IMPLANTS, PERI-IMPLANTITIS.

INTRODUCTION

Implant-supported posterior partial fixed dentures have provided significant improvements in function, aesthetics, and patient satisfaction when compared with classical fixed prosthetic therapy, while prosthetic success rates were not significantly different between the tooth- and implant-supported posterior fixed partial dentures (1-

3). However, various factors that lead to peri-implantitis can compromise the long-term stability of dental implants, which can emerge as primary complications impacting implant therapy success (4, 5). The osseointegration of implants can be impacted by biological, mechanical, or technical complications (6-8). Evaluating peri-implant soft tissues status is essential for the early detec-

Clinical and radiological study on peri-implant status in posterior implant-supported partial fixed dentures

tion of inflammation signs, such as edema or bleeding, which may indicate the initial stages of peri-implantitis. Monitoring peri-implant bone through periodic radiographs helps identify bone loss and assess implant stability, preventing advanced complications (9). Preventively, ensuring rigorous oral hygiene, scheduling regular professional cleaning sessions for implant surfaces, and reeducating the patient on proper brushing techniques are crucial. In early peri-implantitis, non-surgical treatments, such as mechanical debridement and the use of antimicrobial agents, can halt the progression of inflammation and prevent bone destruction. Thus, understanding the peri-implant condition in patients with implant-supported partial fixed dentures is crucial for developing effective preventive measures and non-surgical therapeutic protocols to enhance implant survival rates and overall oral health outcomes (10).

The **aim** of this study was to evaluate the clinical and radiological status of the peri-implant tissues in patients treated with posterior implant-supported partial fixed dentures.

MATERIALS AND METHODS

The retrospective research was conducted on a cohort of 48 patients (age: mean age 63.04 ± 10.723 years, range 40-84 years; gender: 22 men, 26 women). The study included patients treated with posterior implant-supported metal-ceramic fixed prosthetic restorations (FPR-IP) 166 implants). The mean follow-up was 6.19 yrs. (range 5-8 yrs.). All subjects were selected from a pool of patients treated by the same implantologist and oral surgery specialist, performing bone addition procedures, implant surgery and prosthetic restorations. Prosthetic loading was performed 3 months

after implant stage for patients who did not require alveolar bone addition, and 4-9 months for patients who required bone addition. Inclusion criteria: patients with age over 18 yrs.; posterior edentulism (Kennedy Class I and II); metal-ceramic fixed partial dentures with implant-support (FPR-IP); follow-up 5-8 yrs. Exclusion criteria: cantilever-type FPR-IP; aggressive periodontitis in periodontal history; systemic diseases impacting peri-implant tissues (uncontrolled diabetes mellitus, osteoporosis, metabolic disorders); antibiotic therapy in the last 6 months. The study was conducted in accordance with the requirements of the Declaration of Helsinki from 1975, revised in 2008. Written informed consent was obtained from the enrolled subjects. Socio-demographic data (gender, age groups: 40-60 yrs.; > 60 yrs.) and anamnestic data were collected on: smoking status (smokers; non-smokers); periodontal status (periodontal grade according to the Classification of Periodontal and Peri-Implant Diseases and Conditions, World Workshop 2017); compliance to the supportive periodontal/peri-implant therapy; index OHI (Oral Hygiene Index). Patients were classified into four stages of periodontal disease (I, II, III, and IV) according to the classification to the Classification of Periodontal and Peri-Implant Diseases and Conditions (World Workshop 2017) (11). Patient compliance with periodontal/peri-implant supportive therapy (PST) was evaluated according to the recall intervals proposed by Monje *et al.* (2014) (12): compliant patient (attends PST sessions at intervals of ≤ 5 months); occasional compliant (attends PST sessions at intervals of > 6 months); non-compliant patient. Clinical data on peri-implant soft tissues were collected by clinical examination (13).

Peri-implantitis was diagnosed according to the following criteria (14-15): clinical signs of peri-implant inflammation (erythema, edema, bleeding on probing, and/or suppuration); bone loss of at least 3 mm visible radiographically. Radiological examination was performed by CBCT (Sirona Orthophos XG). Measurements were made by an independent radiologist who was not involved in the study. The peri-implant marginal bone loss (MBL) was calculated at the mesial and distal aspects of each implant using the Sidexis XG/DVT application (Dentsply/Sirona): the distance between the implant-abutment interface and the level of peri-implant marginal bone loss. The highest value was used as a reference for determining the degree of peri-implant bone loss.

Statistical Analysis

Descriptive statistics including frequencies, means and standard deviations were calculated for demographics, clinical parameters, and marginal bone loss. The comparison of the qualitative variables between test group and control was performed by using Chi-squared test. Chi-square test was used to examine the statistical differences between implants with peri-implantitis and healthy implants. All tests of significance were evaluated at the

0.05 error level with *SPSS version 27.0* (IBM, Armonk, NY, USA).

RESULTS

At the patient level, 54.2% of patients are healthy or exhibit a state of peri-mucositis (without peri-implantitis), while 45.8% of patients have peri-implantitis, indicating a significant proportion of affected cases at the individual level. At the implant level, 80.1% of implants are classified as healthy or with peri-mucositis, representing the majority of the analyzed implants, while 19.9% of implants show peri-implantitis. This result reflects a lower incidence of this condition at the implant level compared to the patient level (tab. I).

Significant statistical differences were found between patients without peri-implantitis and patients with peri-implantitis for OHI index (0-1 vs. 2-3) ($p=0.011^*$), periodontitis grade ($<0.001^{**}$), and PST compliance (compliant vs. non-compliant) ($p=0.003^{**}$) (tab. II).

Significant statistical differences were found between implants without peri-implantitis and implants with peri-implantitis for gender ($p=0.022^*$), age group ($p=0.018^*$), smoking status ($p=0.007^{**}$), OHI index ($p < 0.001^{**}$), periodontitis stage ($p < 0.001^{**}$), and PST compliance ($p < .001^*$) (tab. III).

TABLE I.

Peri-implant status (per patient; per implant)

Status	Frequency(N)	Percent (%)
<i>Per patient</i>		
Healthy/peri-implantitis	26	54.2
Peri-implantitis	22	45.8
<i>Per implant</i>		
Healthy/peri-mucositis	133	80.1
Peri-implantitis	33	19.9

**Clinical and radiological study on peri-implant status
in posterior implant-supported partial fixed dentures**

TABLE II.

**Distribution of patients with implant-supported fixed prosthetic restorations
based on peri-implant status and socio-demographic factors**

Parameter	Per patient			
	Absent peri-implantitis	Peri-implantitis	Total	p-value+
<i>Gender</i>				
Male	8 (30.8%)	14 (63.6%)	22 (45.8%)	0.023*
Female	18 (69.2%)	8 (36.4%)	26 (54.2%)	
<i>Age group (yrs.)</i>				
40-60	8 (30.8%)	10 (45.5%)	18 (37.5%)	0.295
>60	18 (69.2%)	12 (54.5%)	30 (62.5%)	
<i>Smoking status</i>				
Non-smoker	16 (61.5%)	12 (54.5%)	28 (58.3%)	0.624
Smoker	10 (38.5%)	10 (45.5%)	20 (41.7%)	
<i>OHI</i>				
0-1	21 (80.8%)	10 (45.5%)	31 (64.6%)	0.011*
2-3	5 (19.2%)	12 (54.5%)	17 (35.4%)	
<i>Periodontitis grade</i>				
I	3 (11.5%)	-	3 (6.3%)	< 0.001**
II	9 (34.6%)	7 (31.8%)	16 (33.3%)	
III	14 (53.8%)	5 (22.7%)	19 (39.6%)	
IV	-	10 (45.5%)	10 (20.8%)	
<i>PST compliance</i>				
Compliant	23 (88.5%)	10 (45.5%)	33 (68.8%)	0.003**
Casual	3 (11.5%)	6 (27.3%)	9 (18.8%)	
Non-Compliant	-	6 (27.3%)	6 (12.5%)	
<i>Total</i>	26 (100.0%)	22 (100.0%)	48 (100.0%)	
+Chi-squared test; *p < 0.05 statistically significant; **p < 0.01 statistically highly significant				

TABLE III.

**Distribution of dental implants based on peri-implant status
and socio-demographic factors**

Factor	Per implant			
	Absent peri-implantitis	Implants with peri-implantitis	Total	p-value+
<i>Gender</i>				
Male	59 (44.4%)	22 (66.7%)	81 (48.8%)	0.022*
Female	74 (55.6%)	11 (33.3%)	85 (51.2%)	
<i>Age group (yrs.)</i>				
40-60	43 (32.3%)	18 (54.5%)	61 (36.7%)	0.018*
>60	90 (67.7%)	15 (45.5%)	105 (63.3%)	
<i>Smoking status</i>				
Non-smoker	90 (67.7%)	14 (42.4%)	104 (62.7%)	0.007**
Smoker	43 (32.3%)	19 (57.6%)	62 (37.3%)	
<i>OHI</i>				
0-1	111 (83.5%)	10 (30.3%)	121 (72.9%)	<0.001**
2-3	22 (16.5%)	23 (69.7%)	45 (27.1%)	

Factor	Per implant			p-value+
	Absent peri-implantitis	Implants with peri-implantitis	Total	
<i>Periodontitis stage</i>				
I	6 (4.5%)	-	6 (3.6%)	<0.001**
II	59 (44.4%)	7 (21.2%)	66 (39.8%)	
III	64 (48.1%)	4 (12.1%)	68 (41.0%)	
IV	4 (3.0%)	22 (66.7%)	26 (15.7%)	
<i>PST compliance</i>				
Compliant	118 (88.7%)	10 (30.3%)	128 (77.1%)	<.001*
Casual	11 (8.3%)	9 (27.3%)	20 (12.0%)	
Non-Compliant	4 (3.0%)	14 (42.4%)	18 (10.8%)	
<i>Total</i>	133 (100.0%)	33 (100.0%)	166 (100.0%)	
+Chi-squared test; *p < 0.05 statistically significant; **p < 0.01 statistically highly significant				

DISCUSSION

While any implant present in the oral cavity, requiring additional treatment, is considered a “surviving” implant (16), “success” of a dental implant is associated with implants that are functional and satisfactory for patients. Criteria for a successful implant are as follows: immobility, absence of peri-implant bone loss on radiographic images, attached gingiva width ≥ 2 mm, absence of peri-implant infection (17). We aimed to evaluate of the clinical and radiological parameters directly associated with peri-implantitis definition as provided by Heitz-Mayfield *et al.* (2018) (14) and Renvert *et al.* (2018) (15). In the investigated group, we observed a peri-implantitis prevalence rate at the implant level of 19.9%, higher than prevalence reported by research groups as follows: 7.3% (18), 9.1% (19), 9.8% (20), 9.83% (5), 9.6% (21), 13.5% (26), and 16% (24). Other research groups reported higher values compared to our results such as 23% (24) and 24.9% (25). At the patient level, we found 45.8% of patients with at least one implant affected by peri-implantitis. Other research groups reported mean values of 13.3% (26), 15.1% (18), 16.3% (19), 18.8% (21), 19.83% (5), 26% (23), 37% (22), and

45% (23). A review found that the prevalence of peri-implantitis ranges from 4.7% to 43% at the implant level and from 8.9% to 56% at the patient level (27). The wide variability in peri-implantitis prevalence rates can be attributed to differences in case definitions and evaluation criteria used by various research groups. However, in our study, the prevalence of peri-implantitis can be explained by the lower compliance of patients with periodontal/peri-implant supportive therapy. Regarding the distribution of peri-implantitis cases based on socio-demographic and population factors, statistically significant differences were observed between the percentages of implants without peri-implantitis and those diagnosed with peri-implantitis among smokers ($p = 0.007^{**}$), oral hygiene levels (OHI index) ($p < 0.001^{**}$), the stage of periodontal disease ($p < 0.001^{**}$), and patient compliance with PST ($p < 0.001^{**}$). The correlation between smoking and increased likelihood of peri-implantitis remains unclear (28). However, some authors categorize smoking as a risk factor as smoking changes the composition of the periodontal microbiota, impacting also the immune system, and increases the incidence and progression of periodontal diseases

Clinical and radiological study on peri-implant status in posterior implant-supported partial fixed dentures

associated with higher risk of tooth loss and implant failures (29). Patients with a history of periodontitis who do not fully adhere to supportive periodontal therapy have a significantly higher frequency of severe peri-implantitis cases requiring surgical procedures and/or antibiotic treatments (30).

CONCLUSIONS

Although peri-implantitis affects almost half of the patients (45.8%), the proportion of individual implants affected is lower

(19.9%). Incidence of peri-implantitis was significantly lower to patients with good oral hygiene, non-smokers, grade I-II periodontitis, and patients compliant with periodontal/peri-implant support therapy.

CONFLICT OF INTEREST AND FUNDING

The authors declare that there is no conflict of interest, and they received no specific funding regarding this scientific research.

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