Research Article

		Healthcare
SOLO CROWNS, DENTAL AND PERIODONTAL HEALTH		**Keywords**: tooth loss, periodontal tissue, fixed dental prostheses, gingival inflammation, etc.

Fadil Azizi		PZU "DentA", Tetovo, Republic of Macedonia
Blerim Musliu		PZU "EdentA", Gostivar, Republic of Macedonia
Afrim Shehapi		FZOM, Tetovo, Republic of Macedonia
Renato Isufi		Sherbimi i kirurgjise OMF Qendra Spitalore Unisversitare "Nene Tereza", Tirane.

Abstract

The aim of this paper is to compare the dental and periodontal status in patients with fixed dental prostheses, i.e. solo crowns for up to three years and from three to six years, through the recording of individual parameters indicative to this situation.

Introduction

Nowadays a great deal of people who are physiologically getting older, are motivated to be in good condition as long as possible, referring to physical activity and attractiveness. The motive implies functional and aesthetic satisfaction. The loss of a tooth or more for those people belonging to this category is more than a traumatic event. From the historic point of view, the tooth caries and periodontal illness are the most frequent problems people have faced. These are both causes for tooth losses as well as a reason more for prosthetic rehabilitation. Therefore, help is sought from proshetists in order to recover the previously existing morphology and function of teeth. The epidemiology shows that the distribution, seriousness and stadium of these illnesses are different in different countries in the world [1], which means that in certain cases fixed prostheses can be one of the reasons for the emergence and progression of illnesses, though a necessary solution in cases of lost teeth. Studies reveal that the maintenance of natural dimensions and shape of teeth as a trustful reproduction of crowns, are the most frequent requirements from patients, when it comes to aesthetics. In essence, the inappropriate morphological production of teeth results in negative effects, affecting in first place the periodontium [2]. Special accent is put on the consequences over the periodontal tissue, whose end effect is destruction of periodontal structures resulting in loss of teeth and endangerment of periodontal health in general. The tooth caries, gingival inflammation and periodontal illness are said to be the most frequent complications upon the application of fixed prostheses. Namely, it is well known that complications are caused by the bacteria originating from the dental-gingival plaque accumulated mostly due to the lack of oral hygiene or inappropriate hygienic regime. In Brazil, 48.3% of people aged between 35 and 44 have at least one fixed or mobile prostheses, whereas in patients between 65 and 74, this percentage is even higher and reaches up to 66.5%. Many epidemiological studies point out the fact that socio-economic factors and people's attitude ad approach have the greatest effect on the condition of oral health, regardless of which part of the world we are talking about [3-4]. Today, we can surely say that the main cause of the emergence of periodontal illness is the bacteria from the biofilm, especially perio-pathogenic ones located in hard to reach locations, which also makes their removal quite difficult.

Literature Review

There are many resources which emphasize the relationship between the advanced periodontal affection and dental lesions upon the application of fixed prostheses. Apart from *in vivo* studies, the experimentally induced gingivitis has been described in Löe's study, who verified the thesis for direct involvement of the plaque in the pathogenesis of the periodontal illness[5]. In this context, other studies have also confirmed the importance of controlling the biofilm so that oral hygiene could be maintained [6-7]. Most of them state the fact that the type of construction, the material and the usage time of the construction in the mouth impacts the level of oral health. In this respect, recently special accent has been given to ceramics as one of the most appropriate materials, which are used in fixed prosthodontics. Mojon, Sesma, Yeung [6-8] say that fixed prostheses have a huge impact in the emergence of caries and periodontal condition. Further studies have revealed that there is increased mobility of the teeth, gingival inflammation and creation of periodontal pockets in patients who wear fixed prostheses [9]. Weishaupt [10] examined the influence of metallic-ceramic crowns by attending the gingival index, plaque index, depth of periodontal pockets in six different spots on the tooth. He also studied the cervical flow of the gingival fluid and the IGG. 24 months later, it was revealed that gingival tissue around the ceramic crowns showed significant signs of clinical and inflammation reactions. Al-Wahadini [11] examined the periodontal response through the presence of ceramic crowns in a given group of patients. By applying the Wilcoxon rang test, he noticed that the marginal periodontitis in teeth with crowns showed significantly worse results compared to the values obtained for normal natural teeth. Worse results were also noticed in terms of the depth of periodontal pockets. Namely, the depth of periodontal pockets was greater in crowned teeth compared to the natural ones. The positioning of margins of restoration against the gingiva and the bone has long time been a source of contradictions in periodontology and dentistry in general. Other studies show that the inappropriate positioning of the intracervical depth of the marginal edge of the crown aggravates gingival inflammation [12, 13]. Gingival adaptation of fixed prostheses and regular evaluation of the resources of the periodontal tissue, are the main assets for long-term results in prosthetics.

Materials and Methods

The clinical examination was carried out at the dentistry clinic "Denta" in Tetovo, in cooperation with the Clinic for Oral and Periodontal Illnesses at the Faculty of Dentistry in Skopje. There were forty patients included in the study, aged between 40 and 65, regardless of gender. As regards the anamnesis and clinical examination, an appropriate questionnaire with certain anamnesis and clinical parameters, important for this study, was compiled. The first group included patients (20) who were wearing prosthetic solo crowns not for more than three years, and the second group included patients with prosthetic solo crowns worn for more than three years (three to six). The controlling group consisted of patients with contra-lateral natural teeth (unscraped teeth). The periodontal status was assessed through the following indexes: Sillness-Loe dental plaque index (DPI), gingival inflammation index (GII) suggested by Cowell, index of epithelial apical destruction (EAD) (loss of attachment) and depth of periodontal pockets according to Ramfiord's index. The clinical reports on the examined groups were separately made and then compared. The dental status in examined groups was determined through the application of the method of inspection and probing, and whenever necessary, through analysis of an X-ray photograph.

Results

Charts and tables that follow show the results of our study. They have been distributed in the examined group as well as in the controlling group and divided in two segments: cariogenic and periodontal reports.

Cariogenic report

The distribution of data which refer to the presence of cervical caries in prepared teeth in patients from the examined group and in contralateral teeth in patients from the controlling group, have been shown in Table 1.

Table 1. Distribution of cervical caries in the examined group and the controlling group, depending on the time of usage

Examined group	Examined group /caries			Controlling group/caries		
	No	Yes	row totals	Yes	no	row totals
solo crown up to 3 years	8 10.00%	12 15.00%	20 25.00%	3 3.75%	17 21.25%	20 25.00%
solo crown from 3 to 6 years	6 7.50%	14 17.50%	20 25.00%	7 8.75%	13 16.25%	20 25.00%
All groups	14 17.50%	26 32.5%	40 50%	10 12.5%	30 37.5%	40 50%

In the shown distribution, for χ^2=25.74 and *p*<0,001(p=0,000), there is a significant difference in terms of the presence of caries in the two compared groups.

I. Periodontal Report

The descriptive statistics of values obtained from analyzed parameters in contralateral teeth (solo crowns up to three years) has been shown in Table 2.

Table 2. The descriptive statistics of values obtained from analyzed parameters in contralateral teeth
(solo crowns up to three years)

Parameter	Valid N	Mean	Confidence +95.00%	Confidence +95.00%	Std. Dev.	Minimum	Maximum
IDP	20	0.46	0.36	0.55	0.21	0.16	0.75
IDC	20	0.13	0.07	0.18	0.11	0.00	0.33
IGI	20	0.58	0.47	0.70	0.25	0.16	0.85
IEAM	20	1.90	0.74	1.05	0.33	0.33	1.25
ITL	20	0.49	0.35	0.62	0.29	0.10	0.91
IGR	20	1.05	0.83	1.26	0.47	0.41	1.80

In the group of patients with solo crowns not older than three years, the value of the DPI varies within the interval of 0.46±0.21; the value of the dental calculus varies within the interval of 0.13±0.11; the value of GII varies within the interval of 0.58±0.25; the value of the index of apical migration varies within the interval of 1.90±0.33; the value of the index of tooth luxation varies within the interval of 0.49±0.29; the value of the recession index varies within the interval of 1.05±0.47.

Table 3. Values of analyzed parameters in the examined group / solo crowns used between 3 and 6 years

Parameter	Valid N	Mean	Confidence +95.00%	Confidence +95.00%	Std. Dev.	Minimum	Maximum
IDP	20	0.63	0.55	0.71	0.17	0.33	0.83
IDC	20	0.22	0.13	0.31	0.19	0.00	0.66
IGI	20	0.87	0.74	0.99	0.28	0.33	1.30
IEAM	20	1.56	0.87	1.24	0.40	0.12	1.640
ITL	20	0.31	0.18	0.43	0.27	0.06	0.90
IGR	20	0.92	0.67	1.16	0.52	0.04	1.80

In the group of patients with crowns older than three years, the value of the DPI varies within the interval of 0.63±0.17; the value of the dental calculus varies within the interval of 0.22±0.19; the value of GII varies within the interval of 0.87±0.28; the value of the index of apical migration varies within the interval of 1.56±0.40; the value of the index of tooth luxation varies within the interval of 0.31±0.27; the value of the recession index varies within the interval of 0.92±0.52.

II - The Controlling Group

The descriptive statistics of values obtained from analyzed parameters in contralateral teeth (solo crowns up to three years) has been shown in Chart 1.

The value of the DPI varies within the interval of 0.38±0.16; the value of the dental calculus varies within the interval of 0.14±0.00; the value of the index of oral hygiene varies within the interval of 0.52±0.16; the value of GII varies within the interval of 0.35±0.00; the value of the index of apical migration varies within the interval of 0.55±0.15; the value of the index of tooth luxation varies within the interval of 0.22±0.06; the value of the gingival recession index varies within the interval of 0.51±0.20.
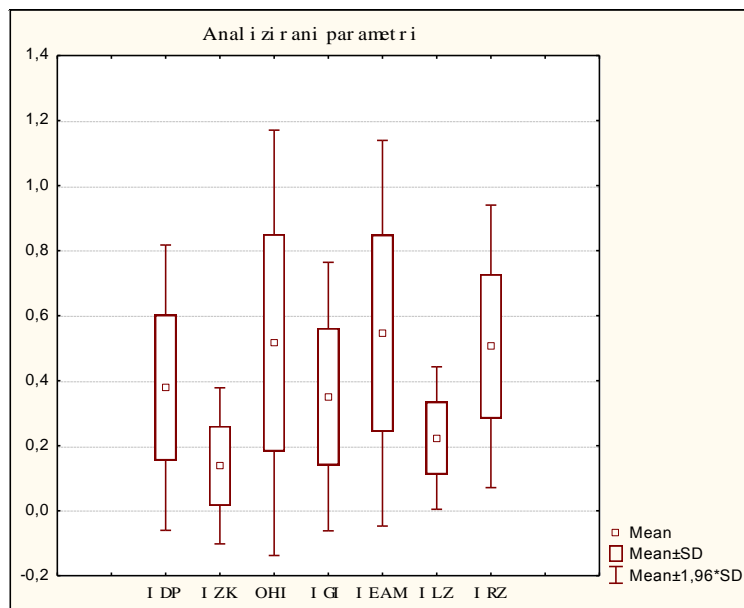

Chart 1. Values obtained from analyzed parameters in contralateral teeth (solo crowns up to three years)

The descriptive statistics of values obtained from analyzed parameters in contralateral teeth (solo crowns from three to six years old) has been shown in Table 4.

The value of the DPI varies within the interval of 0.50±0.16; the value of the dental calculus index varies within the interval of 0.21±0.00; the value of GII varies within the interval of 0.51±0.13; the value of the index of apical migration varies within the interval of 0.61±0.00; the value of the index of tooth luxation varies within the interval of 0.21±0.01; the value of the gingival recession index varies within the interval of 0.44±0.00.

Table 4. Values obtained from analyzed parameters in contralateral teeth
(solo crowns from three to six years old)

Parameter	Valid N	Mean	Confidence -95.00%	Confidence +95.00%	Std. Dev.	Minimum	Maximum
IDP	20	0.50	0.41	0.60	0.16	0.75	0.20
IDC	20	0.21	0.14	0.29	0.00	0.66	0.16
IGI	20	0.51	0.39	0.63	0.13	0.92	0.25
IEAM	20	0.61	0.48	0.73	0.00	1.01	0.26
ITL	20	0.21	0.11	0.30	0.01	0.60	0.20
IGR	20	0.44	0.30	0.58	0.00	1.03	0.30

Differences Between a Three-Year-Old Solo Crown and Contralateral Teeth

Table 5 shows the differences of analyzed parameters in patients with solo crowns used for up to three years and their contralateral teeth. The average value of the index of dental plaque (IDP) in the examined group is greater than the average value of the index of the dental plaque (IDP) in the controlling group (contralateral teeth); however, for Z=1.16 and $p>0.05(p=0.24)$, the difference is not significant.

The average value of the index of tooth calculus (ITC) in contralateral teeth (the controlling group) is greater than in the examined group; however, for Z=-0.23 and $p>0.05(p=0.82)$, the difference is not significant. The average value of the index of gingival inflammation (IGI) in the examined group is greater than in the controlling group (contralateral teeth); however, for Z=2.91 and $p<0.01(p=0.00)$, the difference is not significant.

The average value of the index of epithelial apical migration (IEAM) in the examined group is greater than in the controlling group (contralateral teeth); however, for Z=3.21 and $p<0.01(p=0.00)$, the difference is significant.

The average value of the index of tooth luxation (ITL) in the examined group is greater than in the controlling group (contralateral teeth); however, for Z=2.68 and $p<0.01(p=0.00)$, the difference is significant. The average value of the index of gingival recession (IGR) in the examined group is greater than in the controlling group (contralateral teeth); however, for Z=3.34 and $p<0.001(p=0.000)$, the difference is significant.

Table 5. Differences between three-year-old solo crowns and contralateral teeth.

	Rank Sum examined	Rank Sum controlling	U	Z	p-level	Valid N examined	Valid N controlling
IDP	453.00	367.00	157.00	1.16	0.24	20	20
IDC	401.50	418.50	191.50	0.23	0.82	20	20
IGI	517.50	302.50	92.50	2.91	0.00	20	20
IEAM	528.50	291.50	81.50	3.21	0.00	20	20
ITL	509.00	311.00	101.00	2.68	0.00	20	20
IGR	533.50	286.50	76.50	3.34	0.000	20	20

Differences Between three-to-six-Year-Old Solo Crowns and Contralateral Teeth

Table 6 shows the differences of analyzed parameters in patients with solo crowns used between three and six years and their contralateral teeth. The average value of the index of dental plaque (IDP) in the examined group is greater than the average value of the index of the dental plaque (IDP) in the controlling group (contralateral teeth); however, for Z=2,00 i $p<0,05$(p=0,04), the difference is significant.

The average value of the index of tooth calculus (ITC) in contralateral teeth (the controlling group) is greater than in the examined group; however, for Z=-1.90 and $p>0.03$ (p=0.03), the difference is not significant. The average value of the index of tooth luxation (ITL) in the examined group is greater than in the controlling group (contralateral teeth); however, for Z=1.32 and $p>0.05$ (p=0.19), the difference is significant. The average value of the index of gingival recession (IGR) in the examined group is greater than in the controlling group (contralateral teeth); however, for Z=2.91 and $p<0.01$(p=0.004), the difference is significant.

Tabela 6. Differences of analyzed parameters in patients with solo crowns used between three and six years and their contralateral teeth

	Rank Sum examined	Rank Sum controlling	U	Z	p-level	Valid N examined	Valid N controlling
IDP	484.00	336.00	126.00	2.00	0.04	20	20
IDC	413.50	406.50	196.50	1.90	0.03	20	20
ITL	458.50	361.50	151.50	1.32	0.19	20	20
IGR	517.50	302.50	92.50	2.91	0.004	20	20

Discussion

The answer related to the biological burden capacity of the periodontium from fixed prostheses varies and depends on a series of different factors. Namely, it has already been proven that both mobile and fixed prostheses can represent risk factors for the emergence and development of the periodontal illness [14]. Clinical examinations show that the gingiva under the prosthetically treated teeth can often be inflamed, and recessed, whereas periodontal pockets can become even deeper. The potentially harmful effects from fixed restorations upon the gingiva have been subject to research in many clinics and histological institutions [15, 16]. The caries has been proved to be as one of the most frequent consequences from the usage of solo crowns [3,17]. Cervical caries of prepared teeth is mostly present in solo crowns used between three and six years in 14 patients (17.50%) and in solo crowns used for up to three years in 12 patients (15.00%). The statistical processing of the cariogenic

report in patients with solo crowns used for up to three years, for $p<0.01$ ($p=0.004$), as well as in those having used them between three and six years, for p<0.05 (p=0.03), shows significant difference. Regardless of the type of the fixed prostheses and the usage time, cervical caries was the most frequent problem noticed in the majority of examined samples, which we think is a consequence of the bacterial biofilm, food remaining, the morphology, design and shape of the crown, which undoubtedly affect the level of dental damages.

In our reports, upon the analysis of the presence of cervical caries in prepared teeth, it is evident that there is a difference related to the usage time of the crowns, as well as between the examined and the controlling group.

Conclusions

The dental status showed the existence of cervical caries, which was represented the most in solo crowns for the period between 3 and 6 years.
Seen from the periodontal aspect, the differences between examined parameters in groups with solo crowns with up to three and from three to six years, and the controlling group are statistically significant.

References
1. Moimaz SAS, Saliba NA, Saliba O, Zina LG, Bolonhez MRC. Association between dental prosthesis and periodontal disease in a rural Brazilian community. Braz J Oral Sci 2006;(19):1226-1231.
2. Zitzmann NU, Schilling J, Weiger R, Pastoret MH, Loretan P. Gender-specific dental health issues and treatment considerations. Int J Prosthodont 2007;20(4):360-8.
3. Drake CW, Beck JD. The oral status of elderly removable partial denture wearers. J Oral Rehabil 1993; 20: 53-60.
4. Peterson PE. Priorities for research for oral health in the 21stcentury – the approach of the WHO Global Oral health Programme. Community Dent Health 2005; 22: 71-4.
5. Löe H, Theilade E, Jensen SB. Experimental gingivitis in man. J Periodontol. 1965; 36: 177-87.
6. Tristäo GC, Carvalho JCM, Pustiglioni FE, Saito T. Prothesis:dental plaque control. Rev Assoc Paul Cir Dent 1989; 43:179-82.
7. Mojon P, Rentsch A, Budtz-Jorgensen E. Relationship between prosthodontic status, caries, and periodontal disease in a geriatric population. Int J Prosthodont 1995; 8: 564-71.
8. Yeung AL, Lo EC, Chow TW, Clark RK. Oral health status of patients 5-6 years after placement of cobalt-chromium removable partial dentures. J Oral Rehabil 2000; 27: 183-9.
9. Zlataric DK, Celebic A, Valentic-Peruzovic M. The effect ofremovable partial dentures on periodontal health of abutment and non-abutment teeth. J Periodontol 2002; 73: 137-44.
10. Weishaupt P, Bernimoulin JP, Lange KP, Rothe S, Naumann M, Hägewald S.Clinical and inflammatory effects of galvano-ceramic and metal-ceramic crowns on periodontal tissues. J Oral Rehabil 2007;34(12):941-7.
11. Al-Wahadni AM, Mansour Y, Khader Y. Periodontal response to all-ceramic crowns (IPS Empress) in general practice. Int J Dent Hyg 2006;4(1):41-6.
12. Brägger U, Hirt-Steiner S, Schnell N, Schmidlin K, Salvi GE, Pjetursson B, Matuliene G, Zwahlen M, Lang NP.Complication and failure rates of fixed dental prostheses in patients treated for periodontal disease. Clin Oral Implants Res 2011;22(1):70-7.
13. Dimova M, DosevaV. Changes in correlations between cervical crown edge and marginal gingival in fixed prostodontics. Journal of IMAB - Annual Proceeding (Scientific Papers) 2006;12(2):123-9.

14. Valderhaug J, Ellingsen JE, Jokstad A. Oral hygiene, periodontal conditions and carious lesions in patients treated with dental bridges. A 15-year clinical and radiographic follow-up study. J Clin Periodontal 1993; 30:482-489.

15. Karlson S. Failures and length of service in fixed prosthodontics after long-term function. A longitudinal clinical study. Swed Dent Jour 1989; 13:185-192.

16. Bader JD, Rozier RG, McFall WT, Ramsey D. Effect of crown margins on periodontal conditions in regular attending patients. The prosthetic Journal of dentistry 1991;65:75-7.

17. Valderhaug J. A 15-year clinical evaluation of fixed prostheses. Acta Odontol Scand 1991; 49:35-40.