

ORIGINAL ARTICLE

SEVERITY OF PERIODONTAL DISEASES AND GINGIVAL CREVICULAR FLUID (GCF) VOLUME OF SAUDI PATIENTS IN PUBERTAL STAGE BEING TREATED WITH SOME RESTORATIVE DENTAL MATERIALS

¹Mohammed M. A. Abdullah Al-Abdaly, (MDS, PhD); ²Manae Musa Musleh Al-Ahmari, (BDS, SBP)

ABSTRACT

Objective: The restorative materials on tooth surfaces are predisposing factors for periodontal diseases due to an increase in plaque formation and inflammation of the adjacent gingiva. The attachment of dental plaque to dental restorations is more than that to the tooth surface as a result of specific characteristics of restorative materials like surface free energy inherent and surface roughness. The present study designed to assess the severity of periodontal diseases and gingival crevicular fluid (GCF) volume of the Saudi patients in pubertal stage who treated by some restorative dental materials. **Subjects and Methods:** This clinical study conducted on 120 patients aged between 15-21 years old. The study included three equal groups (40 patients each), 50% males and 50% females. The examined restoration types were: composite resin, amalgam and glass ionomer fillings. After six weeks of dental restorations, the following periodontal parameters: plaque index (PLI), gingival index (GI) and clinical attachment loss (CAL) in mm recorded for each restored tooth, then the gingival crevicular fluid (GCF) collected. Finally, the data analyzed by SPSS to evaluate the periodontal status. **Results:** The results of the present study revealed that there were differences in all periodontal parameters in the comparison between group I, II and III but without statistical significance differences except CAL ($p < 0.5$), moreover, there were significant differences in GCF volume between group I, II and III ($p < 0.05$). **Conclusion:** After six weeks we concluded that there was a significant impact of composite resin, amalgam and glass ionomer fillings on the clinical parameters and GCF volume where we observed that the clinical parameters and GCF volume of amalgam restorations more higher than composite resin and glass ionomer fillings restorations.

Key words: Gingival crevicular fluid, Pubertal stage, Restorative dental materials

^{1,2}Assistant Professor of Periodontics-Periodontics and Community Dental Sciences Department, College of Dentistry, King Khalid University, Abha, Saudi Arabia

Correspondence should be addressed to:

Mohammed M. A. Abdullah Al-Abdaly

Periodontics-Periodontics and Community Dental Sciences
Department, College of Dentistry, King Khalid University,
Abha, Saudi Arabia

Email: malabdali@kku.edu.sa

INTRODUCTION

Periodontal disease is a bacterial chronic inflammatory disease of the tooth-supporting tissues and includes two main types, gingival and periodontal disease. The health of periodontal tissues is as a necessary part for comfort, appropriate aesthetics, and function of the dentition.¹

As we know that there is a dynamic relation between periodontium and restorative dentistry. Consequently, the reactions of periodontal tissues to the dental restorative materials should be clinically evaluated, especially in the restorative gingival contact areas which represent difficult areas for dental treatment due to they are retentive areas for collection of dental plaque and more sensitive to the location of marginal restorations.²

Dental filling design is important, if done badly it may act as a contributing factor by retaining dental plaque or pose difficulty in its removal, thus the position of the margin of the filling below or above gingival margin may be associated with variations in plaque accumulation and inflammation of gingival tissues.³

In earlier studies done by de Waal & Castellucci, (1994)⁴ and Schatzle et al. (2001)⁵, there was association between sub-gingival restorative margins and increased accumulation of dental plaque, gingival inflammation, periodontal pocket depth, destruction of attachment tissues and biological width.

It is also noteworthy that the rough surface of filling materials, particularly on the margins and interproximal areas is a local factor for increased plaque accumulation due to the difficulty in finishing of fillings in these areas and marginal defect.^{6,7} This is consistent with the results of Wise and Dykema (1975) study,⁸ which conducted on plaque retentive ability of four various filling materials, where they found that the polished porcelain is less plaque retentive than enamel while composite and other fillings were more plaque retentive than enamel.

On the other hand, the restorative materials cannot be destructive to the periodontium by themselves, except self-cure acrylics; consequently, restorative materials can chemically or physically deteriorate the oral mucous membrane.⁹ Furthermore, the substances

liberated from restorative materials, directly or indirectly help the progression of the existent gingival inflammation as a synergistic effect with the microbial factor. Additionally, the immune sensitive reaction to these materials, which, if persistent to the sub-gingival structures, will lead to a periodontal destruction.¹⁰

Determining the biocompatibility, toxicity and reverse impacts of dental restorative materials in the interface areas and periodontal tissues may be a fundamental issue.¹¹ Systemic factors act as modifying factors for periodontal disease, which can change the response of periodontal tissues to dental plaque. Through the puberty stage, there are an increase flow of sexual hormones (testosterone in males and estrogen hormone in females) which may produce an alteration in the host response to dental plaque and increased the susceptibility of periodontal disease.¹²

Generally, all the previous studies depended on the clinical examination to evaluate the severity of periodontal diseases, with few studies displaying biochemical changes in periodontal tissue inflammation adjacent to the reconstructed tooth.^{13, 14}

Biochemical evaluation of periodontal reactions may be more rational than clinical examination, especially in the early stage of periodontal disease. Presently, there is insufficient information regarding the periodontal tissues and dental restorative material reactions and their effect on the volume of gingival crevicular fluid (GCF) particularly among Saudi patients in pubertal age. Thus, this study aims to assess the severity of periodontal diseases and GCF volume of Saudi patients in pubertal age after being treated with some restorative dental material.

SUBJECTS AND METHODS

This was a cross-sectional study of 120 Saudi patients in pubertal stage (50% males and 50% females) referred to the outpatient clinics of Periodontics and Community Dental Sciences Department (PCS), College of Dentistry, King Khalid University, from March 2017- September 2017. The patients had no systemic diseases and were not treated by antibiotics nor had received any periodontal therapy within the last three months. They were divided into three equal

groups (n=40) as group I, II and III, according to restorative materials (composite resin, amalgam, and glass ionomer) (Figures 1, 2 and 3).



Figure 1: Clinical view of composite



Figure 2: Clinical view of amalgam



Figure 3: Clinical view of glass ionomer

The samples assessed after six weeks based on inspection and clinical examination by using explorer

to evaluate the margins and surface roughness of the Restorative materials. The periodontal examination conducted with William's periodontal probe to evaluate plaque index (PLI),¹⁵ gingival index (GI)¹⁶ and clinical attachment loss (CAL).

GCF samples collected from the gingival sulcus adjacent of the dental restorations. These areas dried and isolated by cotton rolls and GCF obtained with paper strips (Periopaper®; Ora Flow Inc., Amityville, NY, USA). The strips placed within the gingival sulcus carefully till slight resistance for 30 seconds. The GCF volume in the strips evaluated by volume quantity device (Periotrons 8000; Pro Flow Inc., Amityville, NY, USA).

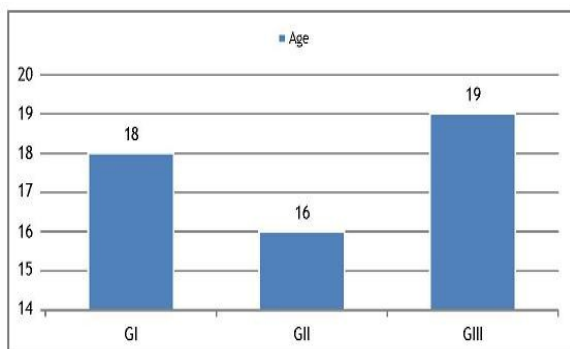
The documentary and oral consent of the patients in the present study obtained after explaining the clinical steps of the study depending on the applied protocol of the Scientific Research. The results were collected and analyzed by SPSS (SPSS Inc., Chicago, IL, USA) 21.0 statistical software where the mean and standard deviation (\pm SD) of clinical findings revealed that there were of statistically significant differences when the p-value was less than 0.05 ($p < 0.05$).

RESULTS

This study included a total of 120 patients. They were treated with restorative dental materials within six weeks. The ages of the patients were ranging between 15-21 years. The mean and standard deviation of ages in this study group were 18 ± 0.41 , 16 ± 0.22 and 19 ± 0.35 years respectively (Table 1 and Figure 4).

Table 1: Age and patients distribution

	Range of Age	Mean and \pm(SD)
I	16-20	18 ± 0.41
II	15-19	16 ± 0.22
III	17-21	19 ± 0.35

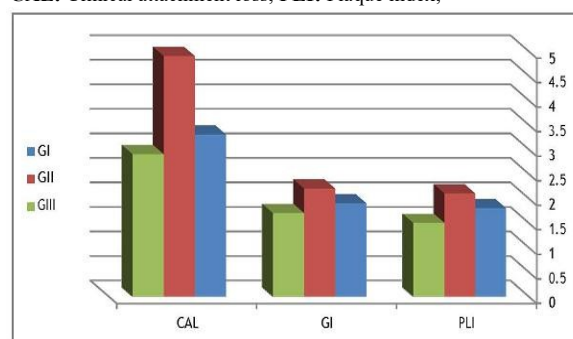


GI: Gingival index

Figure 4: The mean of age

Table 2 and Figure 5 demonstrate the clinical findings of the present study. The mean PI, GI, and CAL of group II was more than that of group I and group III,

CAL: Clinical attachment loss; PLI: Plaque index;



GI: Gingival index

Figure 5: Clinical findings

which may be due to the rough surface of amalgam fillings that are plaque retentive areas.

Table 2: Clinical findings and gingival crevicular volume assessment

Groups	PLI	GI	CAL	GCF volume(μ L)
I	1.8 \pm 0.21	1.9 \pm 0.5	3.3 \pm 0.64	69.3 \pm 3.24
II	2.1 \pm 0.43	2.2 \pm 0.32	4.9 \pm 0.9	133.7 \pm 1.22
III	1.5 \pm 0.54	1.7 \pm 0.31	2.9 \pm 0.71	38.1 \pm 2.50
P. Value	0.14	0.21	0.004	0.001

GCF: Gingival crevicular fluid; PLI: Plaque index; GI: Gingival index CAL: Clinical attachment loss

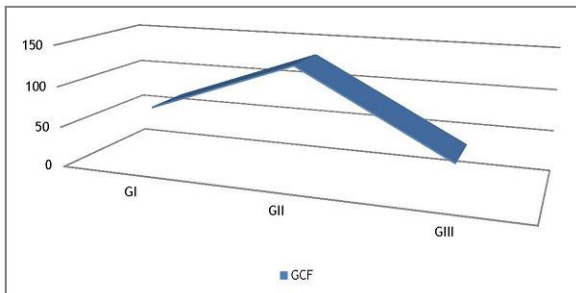
On the other hand, the study also showed that the mean PLI, GI, and CAL of group I was more than that of group III, which may be due to the defect in the polishing of composite fillings, especially interproximal and cervical areas. Furthermore, the gingival tissue sensitive reaction against composite

filling materials may lead to gingival inflammation and periodontal destruction.

There were significant differences in PLI, GI, and CAL on comparing group I, group II and group III in the current study without statistically significant

differences in periodontal parameters except for CAL. The study revealed that there were statistically significant differences in CAL in the comparison between group I, group II and group III ($P < 0.05$).

Regarding the volume of GCF, there was a statistically significant difference among the study groups ($p < 0.05$). It was more in group II than group I and group III, being more in group I than group III (Table 1 and Figure 6).



GCF: Gingival crevicular fluid

Figure 6: Gingival crevicular fluid volume assessment

DISCUSSION

Predisposing factors usually have a localized effect and might increase the likelihood of periodontal diseases due to retention or difficulty in removal of dental plaque.^{17,18} Thus, the evaluation of these factors is essential in the estimation of the patient's periodontal status. This study was conducted to assess the severity of periodontal diseases and gingival crevicular fluid (GCF) volume of the Saudi patients in the pubertal stage after being treated with some restorative dental material.

According to the researchers' knowledge, the current study is one of the first studies that conducted on pubertal Saudi patients for assessing the effect of dental restoration materials on the severity of periodontal diseases by clinical examination and quantitative evaluation of GCF.

The existence of restorative materials on the tooth surfaces is considered to be a local factor for periodontal disease, but that doesn't comply with the

results of previous studies, where there was no significant difference in PLI and GI of restored teeth by composite and ceramic restorations compared to non-restored teeth.¹⁹⁻²¹ These results were consonant with the findings of an experimental 7-day gingivitis study that was carried out by Van Dijk and Sjoström in 1998²² where they found no differences in PLI and GI neighboring to restored teeth by different restorative materials.

On the other hand, the results of Ababnaeh et al (2011) study,²³ showed that there was a destruction of periodontal tissues of restored teeth by class II amalgam and other restorations (especially acrylic and non-precious metals) due to the rough surface of these materials. In another study which conducted on restored teeth with amalgam restorations, there was an increase in plaque accumulation and gingivitis in interdental areas compared to non-restored teeth.²⁴

The clinical results of the study that carried out on glass ionomer and microfilled composite restorations revealed no significant differences in PLI, bleeding on probing (BOP) and periodontal pocket depth (PPD) in the beginning compared to the end of the study.²⁵ These clinical findings were similar to those conducted on different restorative materials in class V restorations, where there were no differences in clinical parameters in all clinical visits.²⁶

In the present study after six weeks, there were clinical differences revealed, in PLI, GI, and CAL between group I, group II and group III. All the groups were subjected to the same conditions at the beginning of this study, with statistically significant differences in CAL ($p < 0.05$), as shown in the table of clinical findings.

Although the results of the current study haven't revealed highly significant differences in plaque accumulation and gingival inflammation, but all the dental restorations acted as an offensive factor for the periodontal tissues, as there were significant changes in all clinical parameters of group II which may be due to the aggressive effect of accumulated bacterial plaque on the rough surface of amalgam restorations. These clinical findings concurred with

those of Kawai K and Urano M (2001)²⁷ that demonstrated the value of a smooth surface to avoid plaque accumulation, and its impact on periodontal tissues.

Moreover, in the present study, there was proof of clinical differences regarding the effect of anatomic shape and marginal adaptation of dental restorations, although they haven't revealed significant differences in PLI and GI but proved beneficial in the plaque control.

On the other hand, the GCF volume of the amalgam restoration sites was higher than those of the composite resin and the glass ionomer sites. This may be due to the rough surface of amalgam restorations, which facilitate the increased accumulation of bacterial plaque than other dental restoration materials in this study. This result is in agreement with the results of other studies that revealed an increase in the GCF volume of restored teeth compared with non-restored teeth, although there were differences in periodontal inflammatory status.^{28,29}

Consequently, the increased volume of gingival crevicular fluid may occur due to stimulation of the periodontal tissues by restorative materials. The reaction between composite resin restorations and periodontal tissues is controversial as some authors reported that composite resin fillings did not cause inflammatory reactions of gingiva like gingivitis.³⁰

This is not consistent with the clinical findings of the present study where moderate gingivitis seen among the patients treated with composite resin fillings and the volume of GCF was 69.3 ± 3.24 (μL); which was more than that seen in patients treated with glass ionomer fillings but less than amalgam fillings.

Moreover, the clinical findings of our study are in agreement with those of van Dijken JW et al (1991), Larato DC (1972) and Willershausen B et al (2001) where they found an increase in the GCF volume with increased gingival inflammation and pocket depth adjacent to composite resin fillings of class V and class II compared with non-restored teeth.³¹⁻³³

Regarding amalgam restorations, previous studies

showed that there was increased gingival inflammation and GCF volume adjacent to these fillings.^{26,34}

This corresponds with the results of Gomes et al (2005)³⁵ histological dog study where they found increased inflammatory infiltration in the gingival sulcus adjacent to amalgam fillings more than composite resin fillings due to increased bacterial plaque around the former. This is consistent with the results of the current study where there were increased gingival inflammation and GCF volume adjacent of amalgam fillings in comparison to composite resin fillings and glass ionomer fillings. Also, the response of periodontal tissues based on the surface roughness of restorative materials rather than its composition. Consequently, additional studies in this field can be made by assessment of the periodontal status of restored teeth with various dental materials before and after dental restorations in follow up visits.

CONCLUSION

In conclusion, the results of the present study revealed that increased in plaque accumulation, periodontal destructions and GCF volume adjacent to the restored teeth with different restorative materials and these results were more pronounced in teeth restored by amalgam compared to composite and glass inner restorations due to its rough surface.

Conflicts of Interest:

There are no conflicts of interest.

REFERENCES

1. Gunay H, Seeger A, Tschernitschek H, et al: Placement of the preparation line an periodontal health-A prospective 2-year clinical study. *Int J Periodont Restor Dent.* 2000; 20:173.
2. Gracis S, Fradeani M, Celletti R, Bracchetti G. Biological integration of aesthetic restorations: factors influencing appearance and long-term success. *Periodontology.* 2000 2001; 27:29-44.

3. Puri K, Puri N, Dodwad V, Masamatti SS. Restorative aspects of periodontal disease: an update part 1. *Dent Update*. 2014; 41(6):545-8.
4. de Waal H, Castellucci G. The importance of restorative margin placement to the biologic width and periodontal health. Part II. *Int J Periodontics Restorative Dent*. 1994; 14(1):70-83.
5. Schatzle M, Lang NP, Anerud A, Boysen H, Burgin W, Loë, H. The influence of margins of restorations on the periodontal tissues over 26 years. *J Clin Periodontol*. 2001; 28:57-64.
6. Pneumas M, Van Meerbeek B, Lambrechts P, Vanherle G & Quirynen M. The influence of direct composite additions for the correction of tooth form and/or position on periodontal health. *J Periodontol*. 1998; 69:422-7.
7. vanDijken, J., Sjöstrom, S. & Wing, K. The effect of different types of composite resin fillings on marginal gingiva. *J Clin Periodontol*. 1987; 14:185-9.
8. Wise M, Dykema R. The plaque-retaining capacity of four dental materials. *J Prosthet Dent*. 1975;33:178- 190.
9. App G. Effect of silicate, amalgam and cast gold on the gingival. *J Prosthet Dent*. 1961; 11:522.
10. Kawakara H, Yamagani A, Nakamura M Jr. Biologic testing of dental materials by means of tissue culture. *Int Dent J*. 1968; 18: 443.
11. Gomes SC, Miranda LA, Soares I, Oppermann RV. Clinical and histological evaluation of the periodontal response to restorative procedures in the dog. *Int J Periodontics Restorative Dent*. 2005; 25(1):39-47.
12. Kinane, Denis F., Melanie Peterson, and Panagiota G. Stathopoulou. Environmental and other modifying factors of the periodontal diseases. *Periodontology*. 2006; 40(1): 107-19.
13. Weishaupt P, Bernimoulin JP, Lange KP, Rothe S, Naumann M, and Hagewald S. Clinical and inflammatory effects of galvano-ceramic and metal-ceramic crowns on periodontal tissues. *J Oral Rehabil*. 2007; 34(12):941-47.
14. Konradsson K, Claesson R, and van Dijken JW. Dental biofilm, gingivitis and interleukin-1 adjacent to approximal sites of a bonded ceramic. *J Clin Periodontol*. 2007; 34(12): 1062-7.
15. Silness J, Loe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand* 1964; 22:122–35.
16. Loe H, Silness J. Periodontal disease in pregnancy I. Prevalence and severity. *Acta Odontologica Scandinavica* 1963; 21:533–51.
17. Marshall R. Predisposing and modifying factors in periodontal disease: The case for mechanical therapy instead of chemicals. *Periodontology* 1998; 19: 7-12.
18. Genco RJ and Borgnakke WS. Risk factors for periodontal disease. *Periodontology* 2013; 62: 59–94.
19. Bollen, C, Lambrechts P. & Quirynen M. Comparison of surface roughness of oral hard materials to the threshold surface roughness for bacterial plaque retention: a review. *Dent Mater* 1997; 13:258-269.
20. Ababneh KT, Al-Omari M, Alawneh TN. The effect of dental restoration type and material on periodontal health. *Oral Health Prev Dent*. 2011; 9(4):395-403.
21. Konradsson K, Claesson R, van Dijken JW. Dental biofilm, gingivitis and interleukin-1 adjacent to approximal sites of a bonded ceramic. *J Clin Periodontol*. 2007; 34(12):1062-7.
22. Van Dijken JW, Sjöström S. Development of gingivitis around aged restorations of resin- modified glass ionomer cement, polyacid-modified resin composite (compomer) and resin composite. *Clin Oral Investig*. 1998;2(4):180-3.
23. Ababneh KT, Al-Omari M, Alawneh TN. The effect of dental restoration type and material on periodontal health. *Oral Health Prev Dent* 2011; 9(4):395-403.
24. Renggli HH, Regolati B. Gingival inflammation and plaque accumulation by well-adapted supra gingival and sub-gingival proximal restorations. *Helv Odontol Acta* 1972; 16(2):99-101.
25. Santos VR1, Lucchesi JA, Cortelli SC, Amaral CM, Feres M, Duarte PM. Effects of glass ionomer and microfilled composite subgingival restorations on periodontal tissue and subgingival biofilm: a 6-month evaluation. *J Periodontol*. 2007; 78(8):1522-8.