Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2018, 7(1): 11-16

Clinical and Radiographical Assessment of Alveolar Bone Loss Associated with Overhang Amalgam Filling

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ABSTRACT

Tooth periodontium are vital structures and affected by the surrounding environments. Overhang amalgam restoration usually results in fracture of the restoration or deteriorated periodontal health. The aim of this study was to report the prevalence of overhang amalgam restorations and to measure the clinical attachment level and alveolar bone loss in overhang surface with comparison to the control intact surface of the same tooth by using digital panoramic radiography. ***Materials and methods:*** *Up to 900 digital panoramic radiographs were evaluated for the presence of overhang amalgam, only 80 overhangs filling detected, the clinical attachment level was measured clinically, and the alveolar bone loss was measured radiographically for overhang surface of the tooth and compared with control normal surface of the same tooth.* ***Results:*** *The prevalence of overhang amalgam was 3.2%, more in mandible and in first molars, the alveolar bone loss and clinical attachment level increased with overhang filling (4.313 mm and 3.731 mm respectively) compared to normal surface (1.9 mm and 1.4 mm respectively) and the difference was statistically significant. The alveolar bone loss was higher in male while clinical attachment level was higher in female, but the differences were statistically non-significant. Mandibular teeth had statistically significant higher bone loss and clinical attachment level than maxillary teeth.* ***Conclusions:*** *Clinical and radiographical examinations play an important role in the diagnosis of periodontal problems as well as measurements of clinical attachment level and bone loss associated with overhang filling which should be avoided as much as possible to maintain the periodontal health and prevent any further destruction.*

Keywords: Overhang amalgam, Alveolar bone loss, Probing depth, Digital radiography

INTRODUCTION

Overhanging amalgam filling is a major dental health problem. It is defined as an extension of restorative material beyond the confines of a cavity preparation [1]. There is good documentation that bleeding, gingivitis and bone loss increases in tissues adjacent to overhangs. So, it is considered as an etiologic factor in the progression of periodontal disease [2].

Incorrect cavity preparation with poorly adapted filling and morphological variation in tooth surfaces (cervical aspect of the tooth, including furcation, fluting, and concavities) contribute to poor restoration with overhang, which makes it difficult to consistently place a wedge and matrix band to fully adapt to the gingival margin [3]. Restoration overhangs have been described as permanent calculus and causes plaque accumulation, caries, and periodontal disease [4].

The main cause of gingival inflammation is due to bacterial plaques along with predisposing factors such as calculus, overhang, orthodontic therapy, smokeless tobacco, radiation therapy, iatrogenic factors, and the materials used in restoration (the design of removable partial dentures) [5,6].

Overhang amalgam filling provide ideal location for accumulation of plaque and result in a change in the ecologic

balance of the gingival sulcus region, resulted in changes in the associated microflora similar to those observed in adult chronic periodontitis. So, increased proportions of gram-negative anaerobic rods, particularly black pigmented bacteriodes were observed. Therefore, overhang restorations not only increase plaque mass, but also increase the specific periodontal pathogens in the plaque [7,8]. Proximal overhangs do not only cause increased accumulation of plaque, they also decrease the access of proximal cleaning devices, such as tooth picks and inter dental tooth brushes [9].

Studies have shown that there is more periodontal attachment loss and inflammation associated with teeth with overhangs than those without them [10]. The effect of an overhanging restoration is to exaggerate these responses by increasing the plaque retention and potentially results in increased rate of destruction of the periodontal tissues [11].

Reasons for the breakdown of fillings are multiple. They range from defective margins of the fillings, fractures, or secondary caries up to the total loss of a restoration. Other possible reasons are periodontal irritations, treatment of primary carious lesions at the restrictive tooth, washed-out fillings, and esthetic aspects particularly at the anterior teeth [12].

Assessment of alveolar bone level in periodontitis is very important in determining prognosis and treatment plan [13]. Many researchers were measured the proximal bone height adjacent to class II amalgam restorations with and without overhangs and compared to the bone height adjacent to homologue intact tooth surfaces (control surface of the same tooth) or to the contra-lateral teeth without overhanging amalgams and demonstrate the alveolar bone necrosis closed to the over hanged amalgam restoration in the proximal box of teeth [7,13-21].

Digital panoramic radiographs were recommended for the assessment of alveolar bone height or bone loss [18,22,23]. An advantage of digital panoramic radiographs is the reduction in radiation exposure in contrast to intra-oral radiography that provides full mouth survey so there was no need for taking many intraoral films, saving times, and the digital software program that provide image manipulation, resolution, and contrast, in addition to direct linear and angular measurements [23-26].

The aim of this study was to report the prevalence of overhang amalgam restorations and to measure the clinical attachment level and alveolar bone loss in overhang surface with comparison to the control intact surface of the same tooth by using digital panoramic radiography.

MATERIALS AND METHODS

In this study, up to 900 patients attended the Oral Diagnosis Department, College of Dentistry, University of Baghdad and referred for radiology clinic for different reasons (from 2012 to 2017) digital panoramic radiograph had been taken with Planmeca romeix, Finland, maxillary and mandibular premolars and molars teeth (excluding third molars) were evaluated for presence of overhang amalgams fillings. the vertical distance from cementoenamel junction to the most apical part of crestal bone was measured using the program software (bone loss was considered when it was more than 2 mm from the cemento-enamel junction (CEJ)). Then patients were referred to the Periodontics Department, clinical attachment level (CAL) was measured by specialist (5 mm or deeper pocket depth were selected and diagnosed with chronic periodontitis). The clinical and radiographical measurements were performed for overhang tooth surface and then compared with the control intact surface of the same tooth. All the measurements were in mm. All data were collected and analyzed using SPSS software program version 16.

RESULTS

From 900 patients, about 9989 posterior teeth evaluated (posterior premolars, first and second molars). Only 2455 posterior tooth was filled and only eighty overhang amalgams filling were detected (3.2%). The mean age of the patients was 41 ± 2 years. About 50 cases were in mandible and the others were in maxilla. Sixty cases in left side and the others were in right side.

Clinical attachment level - overhang surface (CAL-O) was greater as compared to clinical attachment level - intact surface (CAL-N) of the same tooth and the differences were statistically high significant, the mean and SD were 3.7 ± 1.2 mm, 1.4 ± 1.07 mm respectively. Alveolar bone level - overhang surface (BLO) was greater as compared to

alveolar bone level - intact surface (BLN) of the same tooth and the differences were statistically high significant, the mean and SD were 4.3 ± 1.4 mm, 1.9 ± 1.1 mm respectively as shown in Table 1.

Table 1 Descriptive statistics of all groups

Variables	Mean	SD	P value
BLN	1.975	1.139	P<0.001*
BLO	4.313	1.489	
CAL-N	1.463	1.076	P<0.001*
CAL-O	3.731	1.278	
* highly significant; CAL-O: Clinical Attachment Level - Overhang Surface; CAL-N: Clinical Attachment Level - Intact Surface; BLO: Alveolar Bone Level - Overhang Surface; BLN: Alveolar Bone Level - Intact Surface; SD: Standard Deviation			

As per gender distribution, CAL-N was higher in males 1.5 ± 1.1 mm while in females, it was 1.3 ± 0.9 mm. On the other hand, the CAL-O was higher in females 3.8 ± 1.04 mm compared to males 3.5 ± 1.4 mm, but the differences were statistically non-significant. The BLN and BLO were higher in males 2.2 ± 1.2 mm, 4.5 ± 1.7 mm as compared to females 1.7 ± 1.01 mm and 4.1 ± 1.2 mm respectively and the differences were statistically non-significant. The results are shown in detail in Table 2.

Table 2 Gender wise descriptive statistics

Variables	Males		Females		P value
	Mean	SD	Mean	SD	
BLN	2.244	1.215	1.769	1.012	P>0.001 #
BLO	4.512	1.704	4.103	1.209	
CAL-N	1.536	1.163	1.335	0.98	P>0.001 #
CAL-O	3.598	1.463	3.871	1.049	
# Not significant; CAL-O: Clinical attachment level - overhang surface; CAL-N: clinical attachment level - intact surface; BLO: Alveolar bone level - overhang surface; BLN: alveolar bone level - intact surface; SD: Standard Deviation					

According to dental arches, CAL-N and CAL-O were higher in mandibular teeth 1.6 ± 1.07 mm and 3.9 ± 1.2 mm respectively while in maxillary teeth were 1.1 ± 1.02 mm and 3.4 ± 1.2 mm respectively, and the differences were statistically significant. Also, the BLN and BLO were higher in mandibular teeth 2.1 ± 1.2 mm, 4.3 ± 1.6 mm as compared to maxillary teeth 1.8 ± 0.8 mm and 4.2 ± 1.2 mm respectively and the differences were statistically significant. The results are exhibited in detail in Table 3.

Table 3 Descriptive statistics of upper and lower teeth

Variables	Maxilla		Mandible		P value
	Mean	SD	Mean	SD	
BLN	1.83	0.824	2.12	1.288	P<0.001*
BLO	4.21	1.285	4.34	1.611	
CAL-N	1.15	1.027	1.69	1.07	P<0.001*
CAL-O	3.43	1.298	3.91	1.244	
* highly significant; CAL-O: Clinical attachment level - overhang surface; CAL-N: clinical attachment level - intact surface; BLO: Alveolar bone level - overhang surface; BLN: alveolar bone level - intact surface; SD: Standard Deviation					

Most of overhang fillings were in maxillary first molar (31.25%) followed by maxillary second molar (17.5%), mandibular first molar (16.25%), mandibular second molar (15%), mandibular first premolar (7.5%), mandibular second premolar (5%), maxillary second premolar (5%), and the least percentage was noticed in maxillary first premolar (2.5%). The details are shown in Figure 1.

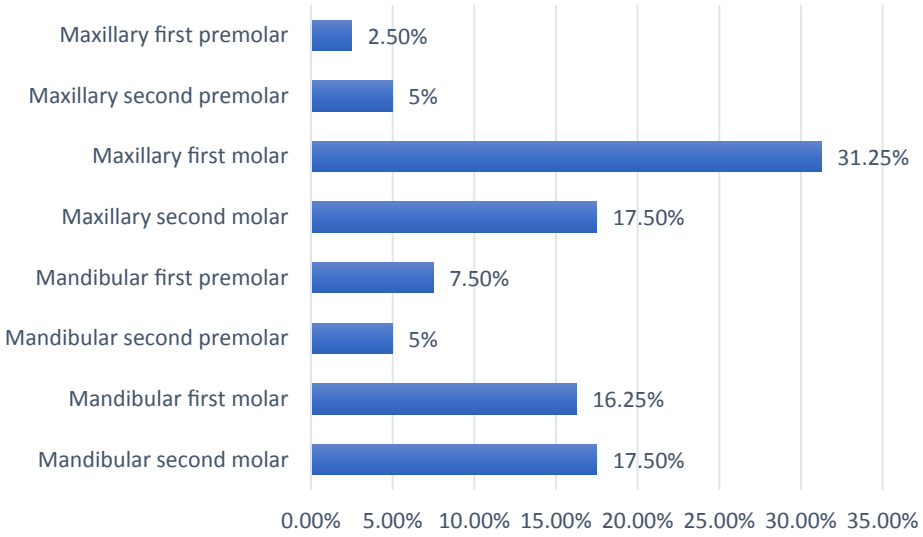

Figure 1 Prevalence of overhang filling in relation to dental arches and teeth

DISCUSSION

Many previous researches approved that overhang amalgam filling had a destructive effect on tooth supporting structures. A high statistical correlation has been reported among incorrect rest oration margins and periodontal disease, and the reduction in bone height [16].

The present study agreed with two studies performed in 1980, one by Jeffcoat and Howell [14] (comparing 100 teeth with overhang restoration with their contralateral 100 teeth without overhang restoration) and the other was by Hakkarainen and Ainamo [15] (examined 85 patients with overhang and compare the bone loss associated with overhang and those of normal teeth). both studies found that bone loss increase with overhang and the differences was statistically significant. but this study disagreed with the prevalence of overhang filling which was reported by the second study as 50% of the posterior teeth included in the study. This difference may be due to different sample size, the progression, knowledge, the educational and directing programs done in the field so the dentists became well trained and realize the destructive effect of overhang filling, so they do their best to prevent it. Also, the difference could be attributed to the fact that the present sample was obtained from a dental college where all procedures are expected to be closely supervised by dental faculty; while previous samples were gathered from general dental clinics.

In 1981, Markkanean, et al., examined 315 OPG and reported average bone loss 1.2 mm. This result is in congruity with the results of the present study [16].

Kells and Linden [17] performed a study in 1992 on 100 patients, Bitewing radiographs were used to examine the proximal surfaces of premolar and molar teeth, excluding third molars. Fifty-seven per cent of the patients had at least one amalgam overhang and 27 per cent had three or more overhangs visible on the radiographs. About (25 per cent) of the restored teeth had detectable amalgam overhangs. Thirty-two per cent of these overhangs filling teeth had bone levels which were greater than 2 mm. The mean bone level-ACJ distance for the control surfaces of the teeth with overhangs was 1.63 mm. These results were in consonance with results of the present study.

In 1992, another study was reported by Akesson, et al., [18]. Panoramic, bitewing and periapical radiography and probing for measurement of the marginal bone level were compare for 237 sites of 23 patients. Probing was done before and during flap surgery, the measurements represented the true value while the radiographical methods were underestimated the bone loss. The underestimation of the bone loss ranged from 13% to 32% in orthopantomograms, 11-23% in bitewing and 9-20% in periapical radiographs. The results of the present study showed non-significant differences between CAL and bone loss measurements done by digital panoramic radiograph and this may be due to modern digital device used and its software program that used to perform the measurements.

In 1998, Parsell, et al., use digital radiography in two phase study. The first phase by comparing the bone loss of accepted filling surface with control surface of the same tooth [19]. while the second phase was done by comparing

the bone loss associated with overhang filling surface with control normal surface of the same tooth. They found significant differences between the two phases and the bone loss was statistical significant with overhang filling. These results were in agreement with the results of the present study.

Gedik, et al., in 2008, performed a study on 21 patients with age ranged between 18-59 years [20]. They measured the bone loss associated with overhang fillings by periapical, bitewing and OPG in addition to measurement of CAL. They reported that bone loss increase with overhang filling and the bitewing film was more accurate to measure the bone level, but on other hand the differences between clinical measurements and those obtained by OPG were statistically not significant.

Kasaj, et al., in 2008 conducted a study on 500 OPG for patients with age ranged between 20-80 years, they conclude that overhang filling was destructive for tooth supporting structures and the bone loss increased with age [23]. The prevalence of overhang was 49.8% and more frequently happened in upper molar with bone loss about 0.6 mm. The present study was partly disagreed with these results, the prevalence was higher, and the mean of bone loss was smaller, these differences may be due to differences in sample size and different methods of measurements.

The results of this study were in conformity with those of Yasar, et al., in 2010 [7]. They compared the bone loss associated with overhang filling in 28 digital bitewings with another bitewing films for the contralateral 28 normal teeth without overhang. They found a significant difference between their measurements and the bone loss increased with overhang fillings.

Recently in 2017, a study was conducted by Saberi, et al., on 60 patients with 90 overhang fillings defects [13]. They measured the probing depth, surgical measurements for bone loss with radiographical measurements using digital caliper on OPG and compare the results. They found a strong correlation between probing depth and surgical measurements and high degree of correlation between surgical and radiographical results. This study was slightly different from the present study because there were no surgical measurements but both of them agreed that bone loss increase with overhang filling and the digital OPG can be used and give accurate measurements.

CONCLUSIONS

- Overhang amalgam fillings are predisposing factor for gingivitis, bone loss and destruction of tooth periodontium.
- The prevalence of overhang filling was decreased to about 3.2%.
- Digital panoramic radiograph accepted as a method for measuring alveolar bone loss (non-significant difference compared to clinical attachment loss measurements).
- Alveolar bone loss was more in mandibular teeth and more in first molars.

DECLARATIONS

Conflict of Interest

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

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