INTRODUCTION

Over-hanging (iatrogenic) tooth restorations can become a risk factor for periodontal breakdown due to the production of environmental changes and disturbance of the balance between beneficial bacteria and periodontopathogens (Nunn, 2003; Lang et al., 1983). Studies have shown that there is more periodontal attachment loss and inflammation associated with overhanging restorations were reported extensively in the literature. A total of 15 overhanging amalgam restorations were selected and the plaque index (PI), Gingival Index (GI), Probing pocket depth (PPD) and Gingival crevicular fluid (GCF) was analyzed. The amalgam overhangs were removed and the readings were repeated at the end of one week and 4 weeks to find out the effect on periodontal health. Statistically significant reductions in all parameters were observed showing improved periodontal health after the removal of the overhang. These observations further highlight the importance of removing the overhanging margins of the restorations as an important part of initial periodontal therapy.

The effect of an overhanging restoration is to exaggerate these responses by increasing the plaque retention potential. In animal model systems plaque retention leads to the extension of gingival inflammation into the periodontal tissues (Lindhe et al., 1973; Saxe et al., 1967). Increased plaque retention results in a greatly increased rate of destruction of the periodontal tissues (Schroeder & Lindhe, 1975). A significantly greater prevalence and degree of severity of periodontal disease are associated with the presence of overhanging restorations. Most studies report an increased level of gingival inflammation and significant loss of alveolar bone associated with the overhang (Gilmore & Sheiham, 1971; Rodriguez-Ferrer et al., 1980).

Therefore, the aim of this study was to compare the short-term clinical changes occurring in the periodontium after the removal of overhanging amalgam, in subgingival restorations. The periodontal status and the changes in the crevicular fluid volume is assessed and compared before and after the removal of amalgam overhangs.
MATERIALS AND METHODS

Fifteen patients (37.46 ± 5.25 years of age) who presented to the Periodontics Clinics, College of Dentistry, King Saud University participated in the study. Inclusion criteria required at least 15 teeth and Class II amalgam restorations with overhang and an interproximal subgingival margin on at least one molar tooth, excluding third molars. These restorations were two surfaces, including the occlusal surface and mesial or distal surfaces. To be considered for the study, the restoration had to have been present in the patient’s mouth for exactly 18-24 months. Out of 10 teeth restored mesially and 13 teeth restored distally, a total of 15 restorations were selected for the study.

Exclusion criteria included the following: cigarette smoking; diabetes; immunocompromised subjects; pregnant and breast-feeding women; subjects with orthodontic devices; subjects with ongoing dental or periodontal treatment 12 months prior to the beginning of the study or those who had taken antibiotics within 6 months prior to the clinical examination; and any medication that could lead to decreased salivary flow. Personal information related to the medical and dental history of the subjects was obtained by a questionnaire. All subjects signed an informed consent.

Periodontal Examination

One trained and calibrated examiner (SM) recorded plaque index, gingival index and periodontal probing depth at the overhang dental surface using a periodontal probe. The reproducibility of these measurements using k statistics resulted in k = 0.82. In addition, the same calibrated examiner evaluated plaque and gingival indices at the same dental surfaces.

Assessment of Restoration Quality The quality of the proximal restoration on each tooth was examined using radiographs and a clinical exploration. Radiographic films were exposed using the bitewing technique and were viewed under standardized conditions using a constant light source without magnification.

For clinical exploration, a dental explorer was moved coronally across the margin of the restoration. Restorations were considered “good” when they presented a smooth junctional surface without a ledge. The “poor” restorations presented a junctional surface with an edge, deficiency, or gross roughness. Selected test teeth presented an edge or overhang raised >0.5 mm from the enamel surface. The restorations were also evaluated using a Cross calculus probe moved coronally across the tooth-restoration junction. Radiographs and all clinical data were obtained at baseline and one week and four weeks after scaling and root planing and overhang removal.

Gingival Crevicular Fluid (GCF)

GCF was collected from the teeth with overhanging restorations. The sites to be sampled were isolated with cotton rolls and carefully sprayed with water to remove saliva followed the method suggested by the manufacturer (Harco Electronics Limited). Each site was gently dried using an air syringe during 10 seconds. A paper strip (Periopaper, ProFlow, Amityville, NY, USA) was inserted at the orifice of the gingival crevice and left there for 30 s. The fluid volume was determined from standard curves using a Periotron 6000 (Periotron, Pro Flow, Amityville, NY, USA). The procedure was repeated at the end of the first week and fourth week after the removal of the overhanging restorations.

Periodontal Therapy

After baseline radiographs were taken and clinical examinations were performed all subjects received standardized oral hygiene instructions. At the same visit, amalgam overhangs were removed either by complete removal of the filing and replacement of new filling or by using a specific system with diamond tips inserted in a hand piece and fine grain diamond-coated rotary instrument. Rubber cups were used as the final step to ensure the smoothness of the surfaces. Bitewing radiographs were taken to assure the quality of the restorations. The teeth received scaling and root planing. After the amalgam overhang removal, the quality of each proximal restoration was re-examined. The patients were recalled at the end of 1 week and 4 week and the measurements were repeated.

Statistical Analysis

The data obtained at the base line, one and four weeks after the treatment were recorded and analyzed statistically using Instat Graph Pad® software (GraphPad Software, Inc. San Diego, CA, USA). ANOVA was used to compare the various groups and post hoc testing (Tukey-Kramer Multiple Comparison Test) was
performed to explore the differences between any two groups. P-Values < 0.05 were considered significant.

RESULTS

The mean plaque index, Gingival Index, Probing pocket depth and GCF volume is given in Table 1 and Fig 1 – 4. The plaque Index reduced significantly after removal of the overhanging amalgam restorations. The values were significantly lower at one week and one month (P< 0.001).

The mean Gingival Index showed significant reduction at one week and one month after the overhang removal (Table 1 and Fig 2). The mean probing pocket depth was 3.80 (SD - 1.15) in the pre treatment group. This has reduced subsequent to the removal of over-

<table>
<thead>
<tr>
<th>Periodontal parameters</th>
<th>Pre-treatment (Mean ± SD)</th>
<th>One week (Mean ± SD)</th>
<th>One week (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plaque Index</td>
<td>1.73 ± 0.46</td>
<td>0.27 ± 0.46</td>
<td>0.13 ± 0.35</td>
</tr>
<tr>
<td>Gingival Index</td>
<td>1.80 ± 0.43</td>
<td>0.2 ± 0.32</td>
<td>0.17 ± 0.27</td>
</tr>
<tr>
<td>Probing Pocket Depth (mm)</td>
<td>3.80 ± 1.15</td>
<td>2.93 ± 1.22</td>
<td>2.33 ± 0.9</td>
</tr>
<tr>
<td>GCF Volume (μl)</td>
<td>0.36 ± 0.06</td>
<td>0.2 ± 0.04</td>
<td>0.14 ± 0.03</td>
</tr>
</tbody>
</table>

Table 1. GI, PI, PPD and GCF Volume before and after the removal of amalgam overhang (one week and one month)

Fig 1. Plaque Index before and after the removal of amalgam overhang (one week and one month)
The Impacts of Amalgam Overhang Removal

Fig 2. Gingival Index before and after the removal of amalgam overhang (one week and one month)

Fig 3. Probing Pocket Depth before and after the removal of amalgam overhang (one week and one month)
The Impacts of Amalgam Overhang Removal

The Gingival Crevicular fluid was estimated using periopaper® (Table 1 and Fig 4). The mean values were found to be 0.36 μl in the pre-treatment group. One month after the removal of the overhanging amalgam restoration the GCF volume has reduced to 0.14. The reduction in GCF values were found to be statistically significantly (P<0.001).

DISCUSSION

Several clinical investigations have shown the detrimental influence on periodontal tissues of amalgam restorations with subgingival, over-hanging margins. An increased attachment loss, deeper periodontal pockets, gingival inflammation, and increased plaque formation associated with overhang restorations (Keszthelyi & Szabo, 1984; Lervik et al., 1984; Roman-Torres et al., 2006). It has been shown that the problem is mainly due to plaque accumulation in relation to the overhang (Gilmore & Sheiham, 1971; Hakkarainen & Ainamo, 1980; Keszthelyi & Szabo, 1984). The overhanging dental restorations and subgingival margin placement play an important role in providing an ecologic niche for periodontal pathogens (Lang et al., 1983).

The relationship of supragingival plaque to overhanging dental restorations was studied earlier to find out the effects of overhang removal (BrunsvoI & Lane, 1990; Gorzo et al., 1979; Highfield & Powell, 1978). These investigators reported more effective plaque control by the patients after overhang removal. In the present study it was observed that plaque scores reduced significantly after removal of the overhanging amalgam restorations. Highfield and Powell (1978) found that removal of overhanging restorations com-
bined with good plaque control resulted in a significant decrease in gingival inflammation.

Gingival inflammation adjacent to overhanging restorations was studied by assessing the bleeding index, or gingival crevicular fluid. Most of the studies reported significantly more inflammation adjacent to overhanging restorations which is in agreement with the present study (Eid, 1987; Gorzo et al., 1979; Lang et al., 1983; Trott & Sherkat, 1964). The presence of gingivitis during restorative treatment predisposes teeth to ODR placement. Bleeding and edema of the tissues hamper access and visibility for proper placement of interproximal restorations. In some instances, therefore, overhangs may result from periodontal disease and then contribute to its progress.

The normal gingival crevicular fluid (GCF) value range from 0.24-1.56 μl and has been proven to be a more sensitive marker of gingival inflammation, and its measurement has become a method widely employed in clinical studies (Cimasoni, 1983). In the present study significant reduction in GCF was observed after the removal of the overhanging amalgam. This observation is in agreement with the other studies reported earlier (Eid, 1986; Eid, 1987; Hadavi et al., 1986).

A consistent finding in several studies was the pocket depth adjacent to overhanging restorations. Pocket depth measurements reflect the level of periodontal attachment. In the present study a significant reduction in pocket depth was observed after removal of the overhanging restoration (Claman et al., 1986; Gorzo et al., 1979; Roman-Torres et al., 2006).

REFERENCES