

Prevalence of Defective Restorations And Their Relationships With Periapical Status in A Selected Sample from Yemen

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Abstract: The present retrospective study aimed to determine the prevalence of overhangs or marginal gap and their relationships with periapical status in restorative teeth. We assessed a database of digital panoramic radiographs from 455 patients. The final sample consisted of 221 radiographs with 748 dental restorative teeth without any root canal therapy. The quality of dental restorations and periapical status were reviewed by checking the post-treatment radiographs. Chi-square test was used to determine statistical significance among different parameters. The Spearman's correlation was also made to determine associations among the studied parameters. The total number of dental restorations was 748, with the majority of mandibular teeth 419 (56.0%). The percentage of restored teeth with adequate restorations was 331 (44.3%), with the best results noticed in mandibular molars 170 (22.7%). The overall percentage of restored teeth with normal periapical condition was 349 (46.7%), with the best results achieved in mandibular molars 138 (18.4%). There were no association were observed between the tooth group and adequacies of the restored teeth ($p > 0.05$). However the relationship between place of dental restoration and incidence periapical lesion was observed ($p < 0.05$). The correlation between the tooth group and periodontal status of the restored teeth were also found ($p < 0.05$). The technical quality of dental restorations performed by Yemeni dental practitioners was poor. Therefore, there is a need to carry out continuing dental education programmes for improving dental practice in Yemen.

Keywords : Dental practitioner, Dental Restoration, Preapical Lesion, Yemen.

I. Introduction

The type of restorations and its placement has a direct relationship with the prevalence of periodontal disease and incidence of secondary dental caries; there is also the relationship of the materials used for each individual restoration [1-5]. Therefore, the adaptation of the margins, the contours of the restoration, the proximal relationships, and the surface smoothness has a critical biological impact on the gingiva and the supporting periodontal tissues. Faults in dental restorations may cause disturbances between the beneficial and pathogenic bacteria present in the oral cavity causes an exacerbation of plaque formation [6, 7], and lead to gingival inflammation and periodontal destruction [8].

The common faulty in dental restorations are overhanging margins and open margin which may lead to periodontal disease. Overhanging margins provide ideal locations for the accumulation of plaque and result in a change in the ecologic balance of the gingival sulcus region, thereby causing an increase in the amount of disease-associated organisms [9]. Proximal overhangs do not only cause increased accumulation of plaque, they also decrease the access of proximal cleaning devices, e.g, tooth sticks, interdental toothbrushes [10]. Therefore, the overhanging restorations have documented sufficient results to state that they contribute to oral environmental changes. Therefore, overhanging restorations pose a significant concern, as their prevalence has been estimated at 25-76% for all restored surfaces [11]. Lang et al. [6] investigated the specific aspects of the local bacterial accumulation associated with overhanging restorations. The placement of subgingival overhangs resulted in changes in the associated microflora similar to those observed in adult chronic periodontitis. On the other hand, secondary caries occur at the plaque accumulation sites, for these reason margins of restorations are more involved. Based on a study, more incidence secondary caries occur at the gingival wall of Class II restorations due overhanging and/or open margins [10, 12-14].

It is generally difficult to examine the contact points and areas on the teeth for the detection of carious lesions or overhanging restorations with conventional clinical examination methods. Radiography is an appropriate means for detection of carious lesions that are not clinically visible. The radiographs have been reported to detect more proximal lesions and inadequate restorative treatments of filled surfaces as compared to clinical examination alone. On radiographic examination, any radiolucency next to restorations was considered as the secondary caries. Thorough examination for overhangs, using both clinical and radiographic assessments, is the most reliable way of diagnosing overhanging margins [13, 15-17].

Yemen is a poor developing country located South-West of Arabian Peninsula to Kingdom of Saudi Arabia. For most people in Yemen, dental care does not have the same intuitive quality of life dimension as health care in general. Additionally, Yemen governorate has been grappling with major health problems such as tuberculosis and malnutrition, and has high mortality rates; as a result, oral health is not yet regarded as a high priority by Yemen governorate [18]. Therefore, Yemeni population does not have access to primary dental healthcare and are not being targeted by any dental educational/preventive programs. Baseline data on oral health status in Yemen itself are sparse.

In Yemen, no published data are available on the prevalence of periapical health related to the quality of dental restorations by dental practitioners. Considering the mentioned issues and for the importance of having accurate statistics regarding the periapical health and its relationships with overhangs or marginal gap of dental restorations, therefore this area was selected as a theme of the current study. The present study aimed to determine the prevalence of overhangs or marginal gap and their relationships with periapical status in restorative teeth of patients presenting to the Dental Health Center in Sana'a, Yemen.

II. Materials and Methods

A retrospective review of digital panoramic radiographs of all patients seen at the Dental Health Center in Sana'a, Yemen 2012 and 2015 was undertaken. This study was approved by the Medical Ethics Committee of Faculty of Dentistry, Thamar University (Ethics No.: 2015/006). We assessed a database of digital panoramic radiographs from 455 patients. The final sample consisted of 221 radiographs with 748 dental restorative teeth without any root canal therapy. The target sample was dental restorations with one or two surfaces, including the occlusal surface and mesial or distal surfaces filled by general dental practitioners. The missing dental restorations from teeth surfaces were also taken into consideration. To be considered for the current study, the digital panoramic radiographic images had good quality. However, those radiographic images presenting deformations were excluded from this study.

The periapical health and the quality of dental restorations were reviewed by checking the post-treatment radiographs. A pro-forma sheet was designed to facilitate data collection and analysis as shown in Table 1.

Table1: Criteria for evaluation used in this study

Parameters	Criteria	Definition
Condition of dental restoration		
	Adequate	Any permanent restoration that appeared intact radiographically.
	Poor	Any permanent restoration with detectable radiographic signs of overhangs, open margins, or recurrent caries, or presence of temporary coronal restorations.
	Missing	No permanent or temporary coronal restoration.
Place of the restoration		
One surface	Occlusal surface.	
One surface	Proximal surface.	
More than one surface	Both surfaces (Occlusal/Proximal).	
Periapical status		
Healthy periodontal ligament	If the periodontal ligament was intact with no signs of periapical pathosis.	
Apical periodontitis	If the widening of the apical part of the periodontal ligament was not exceeding two times the width of the lateral periodontal ligament space, teeth were categorized as having widening of the periodontal ligament.	
Apical periodontitis	If the periapical radiolucency in connection with the apical part of the tooth exceeding at least two times the width of the lateral part of the periodontal ligament, such teeth were categorized as having obvious periapical radiolucency.	

On radiographic examination, any radiolucency next to restorations was considered as the secondary caries. Overhanging margins were recorded on mesial or distal surface, and if the radiograph image showed a step or ledge extending beyond the normal smooth profile of the tooth, or a “beveled” appearance at the base of a proximal restoration, it was attributed to overhang margin present in a concavity on the surface of the tooth. The periapical condition was scored according to the criteria listed in Table 1. The relation of periapical condition and dental restorations adequacy to tooth position (anterior/posterior, maxilla/mandible) was also assessed.

All radiographs were taken by the same operator using a panoramic digital radiography device (Tomography X-ray System Model Pax-Flex 3D Power Input: AC 100-120). All radiographs were reviewed by one dental surgeon. Before the evaluation, the observers participated in calibration training, which consisted of 50 randomly selected panoramic radiographs.

The analysis of the data was performed using SPSS 21.0 for Windows (SPSS Inc., Chicago, IL, USA). Chi-square test of independence was used to determine statistical significance between different parameters. The Spearman's correlation was utilized to assess associations among the studied parameters. The significance level was $P < 0.05$.

III. Results

The total number of dental restorations was 748, with the majority of mandibular teeth 419 (56.0%). On the basis of tooth location as anterior or posterior, the predominance dental restorations were in posterior teeth 697 (93.2%). The most commonly restored teeth were mandibular molars 349 (46.7%), followed by both maxillary molars 220 (29.4%). On the basis of place of the restoration, the highest dental restoration were on occlusal surface 389 (52.0%), followed by proximal surface 280 (37.4%) and both surfaces 79 (10.6%).

The dental restoration (maxilla/mandible, anterior/posterior) and adequacy of the restoration showed in Table 2. There were no statistically significant differences were detected between the dental restoration adequacy of maxillary and mandibular teeth ($p > 0.05$). Equally, no dependence was also recognized between the tooth position (maxilla/mandible) and the place of the restoration ($p > 0.05$). However, statistically significant differences were observed between the periapical status of maxillary and mandibular restored teeth ($p < 0.05$).

Table 2: Dental restoration and periapical status of specimens by tooth location (anterior/posterior, maxilla/mandible)

Tooth Group	Total	Condition of dental restoration			Place of the restoration			Periapical status		
		Missing	Adequate	Inadequate	Occlusal	Proximal	Both	Normal	Widening of PDL	Apical lesion
Anterior teeth	51 (6.8%)	13 (1.7%)	11 (1.5%)†	27 (3.6%)	23 (3.1%)*	18 (2.4%)*	10 (1.3%)*	27 (3.6%)	23 (3.1%)"	1 (.1%)"
Posterior teeth	697 (93.2%)	37 (4.9%)	320 (42.8%)	340 (45.5%)	366 (48.9%)	262 (35.0%)	69 (9.2%)	322 (43.0%)	342 (45.7%)	33 (4.4%)
Total	748 (100%)	50 (6.7%)	331 (44.3%)	367 (49.1%)	389 (52.0%)	280 (37.4%)	79 (10.6%)	349 (46.7%)	365 (48.8%)	34 (4.5%)
Maxillary teeth	329 (44.0%)	19 (2.5%)	139 (18.6%)†	171 (22.9%)	159 (21.3%)*	135 (18.0%)*	35 (4.7%)*	180 (24.1%)	141 (18.9%)"	8 (1.1%)"
Mandibular teeth	419 (56.0%)	31 (4.1%)	192 (25.7%)	196 (26.2%)	230 (30.7%)	145 (19.4%)	44 (5.9%)	169 (22.6%)	224 (29.9%)	26 (3.5%)
Total	748 (100%)	50 (6.7%)	331 (44.3%)	367 (49.1%)	389 (52.0%)	280 (37.4%)	79 (10.6%)	349 (46.7%)	365 (48.8%)	34 (4.5%)

† Statistically significant difference ($P < 0.05$) between adequate coronal restoration of teeth in anterior and posterior teeth.
 * No statistically significant difference ($P > 0.05$) between place of the restoration of teeth in in anterior and posterior teeth.
 "No statistically significant difference ($P > 0.05$) between periapical status of restorative teeth in in anterior and posterior teeth.
 † No statistically significant difference ($P > 0.05$) between adequate coronal restoration of teeth in maxillary and mandibular teeth.
 * No statistically significant difference ($P > 0.05$) between place of the restoration of teeth in in maxillary and mandibular teeth.
 "Statistically significant difference ($P < 0.05$) between periapical status of restorative teeth in in maxillary and mandibular teeth.

On the basis of tooth location as anterior or posterior, dependence was recognized between the tooth position (anterior/posterior) and adequacy of the restoration ($p < 0.05$). Furthermore, statistically significant differences were detected between the periapical status of anterior and posterior restored teeth ($p < 0.05$). However, there were no statistically significant differences were detected between the tooth position (anterior/posterior) and the place of the restoration ($p > 0.05$). No dependence was also seen between the tooth position (maxilla/mandible) and the periapical status of anterior and posterior restored teeth ($p > 0.05$).

Table 3 presents the dental restorations and periapical status according to tooth group. The percentage of restored teeth with adequate dental restorations was 331 (44.3%) where the highest percentage of restored teeth with adequate dental restorations was reported in mandibular molars 170 (22.7%). The overall percentage of restored teeth with normal periapical condition was 349 (46.7%), with the best results achieved in mandibular molars 138 (18.4%).

Table 3: Dental restoration and periapical status of specimens by tooth group

Tooth Group	Total	Condition of coronal restoration			Place of the restoration			Periapical status		
		Missin g	Adequat e	Inadequat e	Occlus al	Proxim al	Both	Normal	Widening of PDL	Apical lesion
Maxillary anterior	47 (6.3%)	11 (1.5%)	11 (1.5%)	25 (3.3%)	23 (3.1%)	15 (2.0%)	9 (1.2%)	26 (3.5%)	20 (2.7%)	1 (.1%)
Maxillary premolar	61 (8.2%)	3 (.4%)	25 (3.3%)	33 (4.4%)	25 (3.3%)	27 (3.6%)	9 (1.2%)	37 (4.9%)	21 (2.8%)	3 (.4%)
Maxillary molar	220 (29.4%)	5 (.7%)	103 (13.8%)	112 (15.0%)	111 (14.8%)	92 (12.3%)	17 (2.3%)	117 (15.6%)	99 (13.2%)	4 (.5%)
Mandibular anterior	4 (.5%)	2 (.3%)	0 (.0%)	2 (.3%)	0 (.0%)	3 (.4%)	1 (.1%)	1 (1%)	3 (.4%)	0 (.0%)
Mandibular premolar	67 (9.0%)	9 (1.2%)	22 (2.9%)	36 (4.8%)	21 (2.8%)	31 (4.1%)	15 (2.0%)	30 (4.0%)	29 (3.9%)	8 (1.1%)
Mandibular molar	349 (46.7%)	20 (2.7%)	170 (22.7%)	159 (21.3%)	209 (27.9%)	112 (15.0%)	28 (3.7%)	138 (18.4%)	193 (25.8%)	18 (2.4%)
Total	748 (100%)	50 (6.7%)	331 (44.3%)	367 (49.1%)	389 (52.0%)	280 (37.4%)	79 (10.6%)	349 (46.7%)	365 (48.8%)	34 (4.5%)

Table 4 shows the correlation between the condition of dental restorations and the periapical status according to tooth group. There were no association were observed between the tooth group and adequacies of the restored teeth ($p > 0.05$). However the relationship between place of dental restoration and incidence preapical lesion was observed ($p < 0.05$). The correlation between the tooth group and periapical status of the restored teeth were also found ($p < 0.05$).

Table 4: Spearman's correlation representing interrelationships among variables

Variables	Tooth	Condition of dental restoration	Place of the restoration	Periapical status
Tooth	---	-.035	-.172**	.120**
Condition of dental restoration	-.035	---	.163**	.272**
Place of the restoration	-.172**	.163**	---	.444**

** Correlation is significant at the 0.01 level (2-tailed).

IV. Discussion

The dental restoration is considered as risk factor for incidence the secondary caries and periodontal diseases. Therefore, the present retrospective study aimed to determine the prevalence of open margins and overhanging inter-proximal dental restorations and their relationships with periapical status in a selected sample from Yemen.

The results of this study emphasize the effects of iatrogenic factors on the incidence of the periapical lesion. These findings supported pervious epidemiological and clinical experimental studies that demonstrated close associations between such iatrogenic factors and the pathogenesis of local periodontal lesions [19-22]. This possibly due that either overhangs or marginal gap that promote an increase in plaque mass as well as caries pathogens in the plaque and may lead to periapical lesion.

Beside restoration techniques, the caries risk factor plays a significant role in restoration survival. A number of studies have reported that recurrent caries is the most common reason for the replacement of dental restorations [9, 23]. The number of restorations replaced as a result of recurrent caries is higher in general dental practice than in controlled clinical trials [24].

Recurrent caries lesions are most often located at the gingival margins that obscure their detection by direct vision. It is difficult to distinguish marginal discrepancies (e.g. ditching) and discoloration from recurrent lesions. As a result, some dentists replace fillings with staining and minor defects in the belief that these clinical signs are indicative of microleakage that leads to caries [25]. In this study, 367 (49.1%) of samples had inadequate margins of the restoration, which indicates that the prevalence of incidence of secondary dental caries and periapical lesion were very high. These results were in agreement with the results obtained from other studies [26, 27]. This is possibly due to the marginal ditching with the advance in age of the restoration and the ensuing microleakage. Marginal gap formation is known as a common disadvantage of composite resins due to polymerization shrinkage or amalgam restoration due to contraction and/or corrosion. The inaccessibility of the cervical area of class II preparations and the problem of moisture control in the posterior region further hinder good marginal adaptation [13]. Results reported in the current study also indicated that there is relationship between place of dental restoration and incidence preapical lesion was observed.

V. Conclusion

Under limitation of the present study, it can be concluded that the frequency of overhanging interproximal margins of restoration and marginal gap under dental restorations was high among dental practitioners. A greater emphasis on the prevention, recognition and prompt removal of overhanging interproximal margins of restoration and good selection of materials for dental restorations are required in order to minimize the risk to preapical health. Based on the reported data in this study, it is need to do continuing dental education programmes for Yemeni general dental practitioners to refresh their knowledge about dental practices.

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