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Original research

FREQUENCY AND LOCALIZATION OF OVERHANGING RESTORATIONS

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ABSTRACT

Objectives: The aim of this retrospective study was to determine the frequency and localization of the overhanging restorations by observing patients' routinely taken panoramic radiographs.

Materials and Methods: The panoramic radiographs of 4,960 patients who applied to a dental clinic in University between 2015 and 2016 and had one or more previous restorations were retrospectively examined. The study group included 243 patients (133 females and 110 males) with a mean age of 39.7 ± 12.5 years. Superposed interdental areas were not evaluated. Frequency distributions and percentages were calculated for the categorical data as to the surface of the maxillary-mandibular premolar and molar teeth, also the presence or absence of root canal treatment. Chi-square tests were used to compare data relating to the localization and frequency of overhanging restorations.

Results: In the radiological evaluation of 243 patients, a total of 280 overhanging restorations were detected. Root canal treatment was present in 45.4% of the teeth with an overhanging restoration. The frequency of overhanging restorations in the maxilla was significantly higher (60.4%) than that of the mandible (39.6%), (p<0.05). The frequency of overhanging restorations in molar teeth (82.9%) was significantly higher than that of premolar teeth (p<0.05). Of all the overhanging restorations, 90.4% were in Class II cavities and 9.6% were in mesio-occluso-distal (MOD) cavities. More than half (57.3%) of the overhanging margins in the Class II restorations were distal; 42.7% were mesial surfaces (p<0.05). The most frequent restorations with overhanging were found in the maxillary molars (49.6%) and the least frequent were in the premolar teeth of the mandible (6.4%).

Conclusions: The restorations with overhanging margins determined most often at the disto-occlusal margins of the maxillary molars. The frequency of overhanging restorations was higher in areas that are difficult to reach during treatment.

Keywords: Dental Marginal Adaptation, Dental Restoration Failure, Permanent Dental Restoration, Molar, Panoramic Radiography.

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INTRODUCTION

An overhanging dental restoration is defined as an extension of the restorative material beyond the cavity preparation borders.[1] Overhanging and inappropriate dental restorations and prostheses are the most common etiologic factors of gingival inflammation and periodontal destruction.[2-5] Working in a very limited area in the mouth and having difficulties accessing certain teeth often causes restorations to overhang in the interproximal areas. In these regions, the polishing procedures are difficult to perform because of the anatomical restrictions causing inadequate polishing.[6] Inadequately polished and overhanging dental restorations prevent patients from practicing oral hygiene in interproximal areas, leading to increased accumulations of plaque and a change in healthy flora.[7] Over time, inflammation in the region due to increased plaque accumulation and periodontal pathogens causes bone destruction.[8] Bleeding, gingival inflammation, and bone loss increase in tissues adjacent to overhanging restorations compared to healthy gingiva. Other causes of bone destruction include the infiltration of overhanging restoration due to biological widening, the intrusion of restoration in interproximal gingiva, and chemical damages of the material due to its contents.[6,9]

The biological width is defined as the size of the soft tissue that connects the tooth's coronal part to the top of the alveolar bone. In studies conducted by Gargiulo *et al*.[10] in 1961, it was reported that in humans, an average of 1.07 mm of connective tissue attachment presents on the alveolar cortex, with an epithelial attachment of just 0.97 mm below the gingival base. The sum of these two distances is defined as the biological width. Inflammation occurs primarily in the gingiva as a consequence of the violation of the biological width.[11] If overhanging restoration is not recognized, clinical attachment loss is followed by bone loss, and clinically this results in a deep periodontal pocket or gingival recession.[12] To avoid these unwanted situations, it is important to diagnose and treat overhanging restorations on time.

The most common cause of overhanging dental restorations is iatrogenic due to inadequate physician skill. Creep may play a role in gingival overgrowth of large amalgam restorations.[13] In some cases, marginal adjustment of the restoration may not be achieved although careful restoration is established. Differences and irregularities in root anatomy can make marginal adjustments difficult.[14] Every restoration change causes some dental tissue loss and the preparation enlarges.[15] For this reason, while the overhanging restorations are being renewed, the new restoration should be done with care, considering the reason for the overhanging.

It is difficult to detect overhanging restorations of posterior teeth with conventional clinical examination methods. Clinical examination alone is inadequate for detecting overhanging fillings when compared to clinical examination with bite-wing radiographs.[16] Bite-wing radiographs alone have been reported to detect more overhanging restorations compared to clinical examination alone.[17] The most reliable method of diagnosing overhanging restorations is to combine both clinical and radiological examinations.[18] Optimal evaluation can be done with bite-wing radiographs, but panoramic and periapical radiographs can also be used to diagnose overhanging restorations. Studies with panoramic radiographs are available in the literature.[19,20]

The purpose of this study was to determine the frequency and localization of the overhanging restorations by investigating the routinely taken radiographs and to specify the teeth, cavity shapes, localization, and root canal treatment presence were frequently encountered with overhanging restorations and whether there were significant relationships among these variables.

MATERIALS AND METHODS

The permissions necessary for this study were obtained from the Scientific Research Ethics Committee of Trakya University (ID: TÜTF-BAEK 2016/235). In this retrospective study, panoramic radiographs and demographic features of the 4,960 patients who applied to dental clinic

in university between 2015 and 2016 were examined by the same observer (M.B.D.).

The study group includes a total of 243 patients between 18-70 years of age who had at least one obvious overhanging restoration which could be evaluated properly at the panoramic radiographs. The patients whose the demographic features could not be accessed, deciduous teeth, non-contacted fillings and superimposed interdental spaces were excluded from the study.

The digital panoramic radiographs that were utilized were taken with a panoramic x-ray device (Pax-Flex 3D Vatech, Hwaseong, South Korea) at the department of radiology of Trakya University, Faculty of Dentistry. None of the panoramic radiographs were obtained specifically for this study. After panoramic radiographs of overhanging restorations were examined; type, location, cavity design, and root canal treatment presence of teeth were recorded.

Statistical analysis

Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 22.0 (SPSS Inc., Chicago, IL, USA). Frequency distributions and percentages were calculated for the categorical data as to the surface of overhanging restorations present on the maxillary and mandibular premolar and molar teeth, also the presence or absence of root canal treatments. Chi-square tests were used to compare the data on the localization and frequency of overhanging restorations. All results were considered significant at $p<0.05$.

RESULTS

Overhanging restorations were observed in 5% of patients with previously restored teeth. In the radiological evaluation of 243 patients in the study group, a total of 280 overhanging restorations were detected. Of those, 82.9% were in molars and 17.1% were in premolars. Of all the overhanging restorations, 60.4% were observed in the maxilla. Most overhanging restorations were observed in the maxillary molar teeth (49.6%) while the least was observed in the mandibular premolar teeth (6.4%) (Table 1).

Table 1. Locations of overhanging restorations.

Location	Premolar Number (frequency %)	Molar Number (frequency%)	*p*-value
Maxilla	30 (10.7%)	139 (49.6%)	0.87
Mandible	18 (6.4%)	93 (33.2%)	

Chi-square tests were used to compare the data.
*$p<0.05$ is statistically significant.

Root canal treatment was observed in 45.4% of the teeth with an overhanging restoration. A total of 90.4% of the overhanging restorations were in Class II and 9.6% were in mesio-occluso-distal (MOD) cavities. More than half (57.3%) of the overhanging restoration margins in the Class II cavities were on distal interfaces while 42.7% were on mesial interfaces (Table 2).

Table 2. Cavity designs of overhanging restorations.

Cavity Design	Premolar Number (frequency%)	Molar Number (frequency%)	*p*-value
MO	6 (2.1%)	102 (36.4%)	0.00*
DO	40 (14.3%)	105 (37.5%)	
MOD	2 (0.7%)	25 (8.9%)	

MO: Mesio-occlusal**,** DO: Disto-occlusal, MOD: Mesio-occlusal-distal
Chi-square tests were used to compare the data.
*$p<0.05$ is statistically significant.

The frequency of overhanging restorations was found to be significantly higher on the maxilla (60.4%) than the mandible (39.6%) ($p<0.05$). The frequency of overhanging restorations in molar teeth (82.9%) was significantly higher than that of premolar teeth ($p<0.05$). The frequency of overhanging restoration in disto-occlusal cavities was

significantly higher than that of other cavities (p<0.05) (Table 3) (Figure 1).

Table 3. Statistical analyses of location, tooth type and cavity design of overhanging restorations.

Parameters		Number (frequency%)	*p*-value
Location	**Maxilla**	169 (60.4%)	0.001*****
	Mandible	111 (39.6%)	
Tooth Type	**Premolar**	48 (17.1%)	0.000*****
	Molar	232 (82.9%)	
Cavity Design	**MO**	108 (38.6%)	0.000*****
	DO	145 (51.8%)	
	MOD	27 (9.6%)	

MO: Mesio-occlusal**,** DO: Disto-occlusal, MOD: Mesio-occlusal-distal
Chi-square tests were used to compare the data.
*p<0.05 is statistically significant.

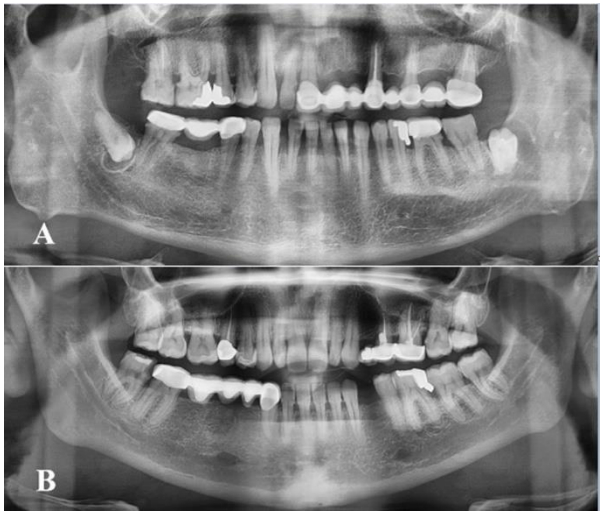

Figure 1. Panoramic images of overhanging Class II restorations. A, mandibular left second premolar; B, mandibular left first molar.

DISCUSSION

Overhanging restorations may increase plaque accumulation and cause gingival inflammation, periodontal tissue damage, and also particularly decrease in alveolar bone height.[17,21,22] Also, overhanging restorations are one of the reasons for secondary caries that can cause infection in the pulp.[23] Increased gingival index, hemorrhage index, periodontal pocket depth, and bone loss were observed in the gingiva adjacent to the contact of the overhanging restoration margins.[6,24-26] Overhanging restorations have been reported to cause flora changes similar to chronic periodontitis in the gingival sulcus adjacent to the overhanging restoration margin.[27] An increase in gram-anaerobic bacteria, especially black-pigmented *Bacteroides* in the flora of the gingival sulcus was observed.[7] Roman-Torres *et al.*[28] reported that renewing of the overhanging restorations is associated with a reduction in the amount of *Actinobacillus actinomycetemcomitans* in flora. For these reasons, the timely diagnosis and treatment of overhanging restorations are very important.

The radiographic evaluation has an important role in the diagnosis of overhanging restorations.[18] Normal anatomic contact areas of the posterior teeth make difficult the conventional clinical diagnosis of overhanging restorations. Although bite-wing radiographs are more detailed than panoramic radiographs, the panoramic radiographs routinely taken for oral diagnosis have been used in the literature for various purposes.[29,30] The fact that bite-wing or periapical radiographs are more successful in the interface evaluation and diagnosing overhanging restorations, the present study has a limitation because of the evaluation of existing panoramic radiographs in order not to expose patients to extra radiation. Besides only the panoramic radiographs were evaluated and oral examinations were not done in this study to detect the overhanging restorations. Therefore, the soft tissue responses to overhanging restorations could not be observed intra-orally. On the other hand, all radiographs were evaluated by one observer as well as in other studies[30,31] to prevent the differences due to the observer.

In previous studies, the frequency of the overhanging restorations has been reported to be

in the range of 16.5% to 76%. When only evaluating overhanging amalgam restorations, 74% was reported by Gorzo *et al.*[32]; 58% was reported by Quadir *et al.*[16]; 51% was reported by İbraheem *et al.*[35], and 22.2% was reported by Baharlooei *et al.*[20] When evaluating all overhanging restorations, Muryani *et al.*[21] reported 75.4%; Matvijenko *et al.*[6] reported 50.8%; Tavangar *et al.*[33] reported 36.6%; Gilmore and Sheiham[3] reported 32%, and Kuonen *et al.*[34] reported 14.1%. According to a recent study conducted by Najm *et al.*[24], the frequency of overhanging restorations was reported as 3.2%. Similar to the results of the present study, the frequency of overhanging restorations was 5%. The reason for the restoration frequency being higher in other studies may be due to the difference in methods. The frequency of studies with the radiographic evaluations in conjunction with clinical examinations was found to be higher because a small clinical overhanging can be detected by probing; that might not necessarily be the case with the radiographic examination. In more recent studies, the reported frequency has decreased due to the progress of knowledge, education, and technology.

Similar to other studies[16,18,33], this study shows that overhanging restorations are significantly higher in the maxilla. Quadir *et al.*[16] found that the frequency of overhanging restorations was 65% in the maxilla. A similar result was observed in the present study, which was 60.4%. It is thought that the reason for the more overhanging restoration presence in the maxilla is related to the difficulty of indirect sight and limited access to this area during treatment.

This study reported that the frequency of overhanging restorations is higher in molar teeth. This finding is similar to those of previous studies.[16,33] Overhanging restorations were observed most frequently in Class II cavities. It is expected that this is because Class II is the most common type of cavity.[32]

In the present study, most of the overhanging restorations were observed in the maxillary molars (49.6%), supporting the results of other studies.[16,24,33,35] It was observed that the frequency of overhanging restoration was the lowest in the premolar region of the mandibula (6.4%). The results of this study and those from Najm *et al.*[24] are similar. Najm *et al.*[24] also stated that the highest overhanging restoration was in the maxillary molar teeth (31.2%), while the least amount of overhanging restorations was in the mandibular premolar teeth (5%).

The authors of various studies[16,33,36,37] have shown that overhanging restorations on distal surfaces are higher than overhanging restorations on mesial surfaces. Similarly, in the present study, overhanging restorations were most often encountered on distal surfaces (53.7%).

Although overhanging restorations are usually iatrogenic, it has been understood that dental anatomy and materials used may also be responsible for it. According to the literature, there is a relationship between overhanging restorations and the matrix type used. It has been pointed out that the possibility of overhanging restorations made with environmental matrix systems is higher than that of sectional matrix systems.[38, 39] Besides, in the restorations made with transparent matrix and reflective wedges, more overhanging restorations were detected than with metal matrix and wooden wedges.[40] The adaptation of transparent matrices is difficult compared to that of metal matrices and it is not possible to adapt as tightly as with metal matrices. Reflective wedges are very stiff and cannot be adapted well to natural anatomical contours when compared to wooden wedges.

With the increase of physician consciousness and the development of materials used, the frequency of overhanging restorations is decreasing, but they cannot be completely avoided despite clinicians' best efforts. There is still a high frequency of overhanging restorations in teeth with anatomical differences, especially in the areas where the physician has restricted time and access to appropriate materials and the patient load is high. As a result, more emphasis should be placed on the prevention, identification, and rapid removal or correction of overhanging margins of restorations to minimize the risk of periodontal disease.

CONCLUSIONS

Management of restorations with excessive dental hard tissue loss is challenging. For the prevention of overhanging restorations, treatment steps should be followed precisely and effective usage of dental matrices systems and wedges must be taken into consideration. In the future, clinicians would be better able to handle overhanging margins due to the progress of knowledge, education, and technology.

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CONFLICTS OF INTEREST STATEMENT

The authors report no conflicts of interest.

Taşkın Restorasyonların Görülme Sıklığı ve Lokalizasyonları

ÖZ

Amaçlar: *Bu retrospektif çalışmanın amacı, hastaların rutin olarak çekilen panoramik radyografilerini inceleyerek taşkın restorasyonların görülme sıklığını ve lokalizasyonunu belirlemektir.* ***Gereç ve Yöntemler:*** *2015-2016 yılları arasında Üniversitede bir diş kliniğine başvuran ve önceden bir veya daha fazla restorasyonu olan 4.960 hastanın panoramik radyografileri retrospektif olarak incelendi. Çalışma grubuna yaş ortalaması 39,7±12,5 olan 243 hasta (133 kadın ve 110 erkek) dahil edildi. Süperpoze olmuş interdental alanlar değerlendirmeye alınmadı. Dolgulardaki taşkınlıkların alt-üst çene premolar ve molar dişlerin hangi yüzeylerinde olduğu ve dişlerde kanal tedavisi olup olmadığına ilişkin kategorik veriler için frekans dağılım ve yüzde değerleri verilmiştir. Taşkın kenarlı dolguların lokalizasyonu ve görülme sıklığına ilişkin verilerin karşılaştırılmasında Ki kare test kullanıldı.* ***Bulgular:*** *243 hastanın radyografik değerlendirmesinde toplam 280 tane taşkın dolgu varlığı tespit edildi. Taşkın dolgusu olan dişlerin %45,4'ünde kanal tedavisi mevcuttu. Taşkın dolguların üst çenede görülme sıklığı (%60,4), alt çenede (%39,6) olanlara göre istatistiksel olarak anlamlı derecede yüksek bulundu (p<0,05). Molar dişlerde taşkın dolguların görülme sıklığı (%82,9) premolar dişlere oranla istatistiksel olarak anlamlı şekilde yüksektir (p<0,05). Taşkın ara yüz restorasyonlarının %90,4'ü iki yüzlü kavitelerde, %9,6'sı mesio-okluzo-distal (MOD) kavitelerdedir. Klas II restorasyonların taşkın kenarlarının yarısından fazlası (%51,8) distal yüzeyde, %38,6'sı mesial ara yüzeydedir (p<0,05). Taşkın kenarlı restorasyonların en fazla üst çene molar (%49,6), en az alt çene premolar dişlerinde (%6,4) olduğu görülmüştür.* ***Sonuçlar:*** *Taşkın kenarlı restorasyonların en sık üst çene molar dişlerinin disto-okluzal yüzeylerinde olduğu saptanmıştır. Taşkın restorasyon görülme sıklığı tedavi sırasında ulaşılması zor olan bölgelerde daha fazladır.* ***Anahtar kelimeler:*** *Dental marjinal adaptasyon, dental restorasyon başarısızlığı, kalıcı dental restorasyon, azı dişi, panoramik radyografi.*

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