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Research Article

The Prevalence of Overhang and Gap Formation in Posterior Amalgam and Composite Restorations Among 4th and 5th Stage Undergraduate Students/Tishk University

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Abstract

Background: Overhanging approximate restoration may cause gingival aggravation periodontal tissue devastation, diminishes alveolar bone height, and recurrence of caries. Gap formation from margin of restoration may cause food impaction which leads to caries recurrence and if it happens inside restoration it will lead to weakening of restoration.

Aims of the Study: The present study aims to assess the overhang and gap formation frequency in patients who visited the dental clinic of Tishk University of Medical sciences/conservative department for 4th and 5th grade undergraduate course.

Materials and Methods: A random sample was collected from patients required class II restorations attending conservative department/dentistry college/Tishk University according to questionnaires which have been made for 4th and 5th grades that include personal information and type of restorative material which has been used, radiographs were taken (posterior bitewing) utilizing paralleling technique, then viewed on computer and change pictures' contrast, printed out and bound with its own questionnaire. Statistical analysis was done using chi-square test at $P < 0.05$ to find out the relationship.

Results: There was a statistically significant association between overhang and the following parameters: gender of clinician, type of tooth, type of restoration at $P < 0.05$ level, while non-significant difference was found between overhang and following parameters; student's grade, gender of patient, location of tooth in jaw, and side of restoration at $P > 0.05$ level.

For Gap Formation: There was a statistically significant association between gap formation and the following parameters: location of tooth in jaw, side of restoration, and type of restoration at $P < 0.05$ level. While there were non statistically significant relationships between gap formation and the following parameters: student's grade, gender of patient, gender of clinician, and type of tooth at $P > 0.05$ level.

Conclusion: According to the present study, 20% of all surfaces that have been restored showed presence of overhang while (80%) were free from overhang, in relation to gap formation (25.6%) of restorations have gap formation while (74.4%) were free.

Keywords: Overhang; Gap Formation; Prevalence; Restorations

Introduction

The direct restoration of a Class II preparation is to re-establish form and function by utilization of a matrix system. Two potential issues related with this method incorporate initially, the capacity to reestablish a contact point with the adjacent tooth surface(s), which is fundamental to counteract food impaction and the ability to anticipate expulsion of abundance restorative material at the gingival margin of the preparation [1]. Such abundance may cause periodontal issues including critical loss of alveolar bone [2]. Improper matrix band placement could bring about poor contours or contacts, overhangs and in addition gap formation coming about because of ineffectively condensed restorative material. An assortment of wedges is accessible to help contouring the matrix to the cavity with the point of lessening the expulsion of abundance dental material and formation of an overhang [3].

A dental restoration ought to reestablish form, function, and esthetics of a tooth involved and consequently Prevent the occurrence of recurrent caries and periodontal distraction. Studies have demonstrated that large overhanging restorations may elevate periodontal diseases because of local aggregation of bacterial plaque rather than mechanical irritation [4]. Epidemiological and clinical trial examines have exhibited close relationship between such iatrogenic components and the pathogenesis of local periodontal lesions [5-7].

Faulty dental restorations and prostheses are basic reasons for gingival inflammation and periodontal destruction [8]. Al-Hamdan, 2008 [9], thorough examination for overhangs, utilizing both clinical and radiographic appraisals, is the most reliable method for diagnosing overhanging margins. Paarman and Beckman, 2005 [10], Meltem Tekbas et al., 2020 [11]; an overhang is characterized as an augmentation of restoration beyond the limits of a cavity preparation. From different examinations, it is evident that such overhangs are alarmingly common. Chan and Chung, 2009 [12], overhanging margins give perfect areas to the collection of plaque and result in a change in the ecologic balance of the gingival sulcus region, along these lines causing an increase in the number of disease-associated organisms. Areej et al. [8] and Yasar et al, 2010 [13], proximal overhangs do not just aim increased amassing of plaque, they additionally diminish the entrance of proximal cleaning gadgets, e.g, tooth sticks, interdental toothbrushes [14,15].

Aims of Study

This study aimed to assess the overhang and gap formation frequency in patients who visited the Dental Clinic of Tishk university of Medical Sciences conservative department for 4th and 5th grade undergraduate course.

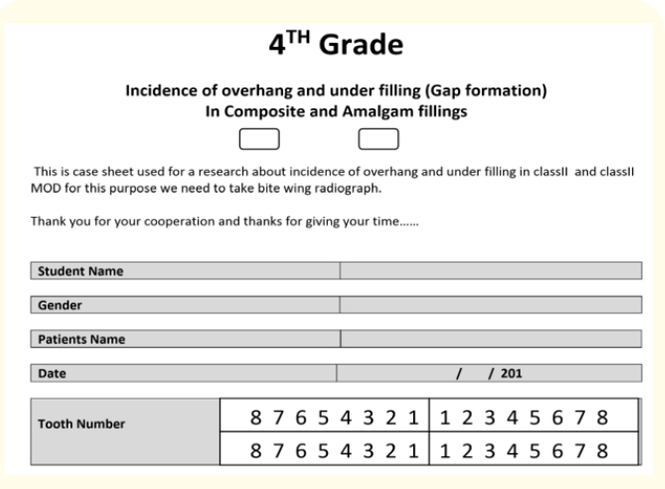
Materials and Methods

In the present study, the sample was collected randomly from patients who required Class II restoration and attended to the Conservative Department in College of Dentistry of TISHIK University. The collection of samples has been arranged according to questionnaires which have been made for 4th (Figure 1) and 5th (Figure 2) Grade which includes Personal information related to the name of patient, gender, number of tooth, type of restorative material which has been used, date, and name of student. At first questionnaires have been filled for those patients who has class II.

restoration, all the students in 4th and 5th grade did their Class II restoration using standard technique (suitable Band, Retainer, Wedge) and they did filling by (3M ESPE composite (Figure 3), charisma Flowable Composite (Figure 4), Travlin Gel for Etching (Figure 5), Bond 2.1 (Figure 6) for Bonding) or they did filling by (Ardent future high cupper non gamma-2 alloy (Figure 7)) after the clinician finished his/her work Posterior bitewing (Figure 8) radiographs were taken by researcher and utilizing paralleling technique. All radiographs were viewed on computer and change picture's contrast and Gamma on EasyDentV4 (Figure 9) program after that printed out and bound with it's own questionnaire. All X-rays evaluated by three examiners. And SPSS program is used for data analysis.

Materials

Questionnaires



4TH Grade

Incidence of overhang and under filling (Gap formation)
In Composite and Amalgam fillings

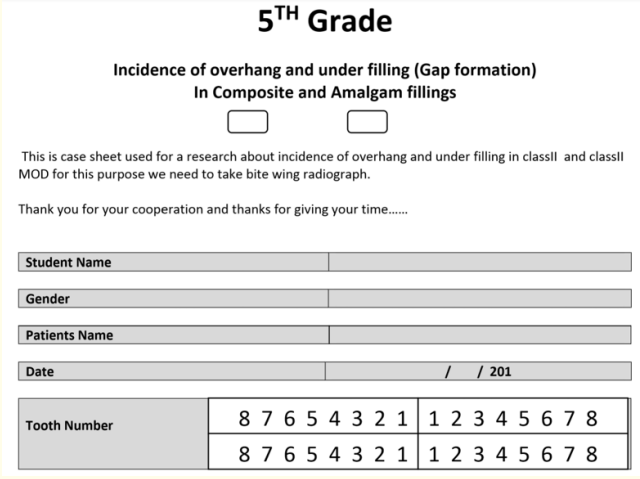
This is case sheet used for a research about incidence of overhang and under filling in classII and classII MOD for this purpose we need to take bite wing radiograph.

Thank you for your cooperation and thanks for giving your time.....

Student Name	
Gender	
Patients Name	
Date	/ / 201

Tooth Number		
	8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
	8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Figure 1: Is questionnaire which has been used for 4th grade.



5TH Grade

Incidence of overhang and under filling (Gap formation)
In Composite and Amalgam fillings

This is case sheet used for a research about incidence of overhang and under filling in classII and classII MOD for this purpose we need to take bite wing radiograph.

Thank you for your cooperation and thanks for giving your time.....

Student Name	
Gender	
Patients Name	
Date	/ / 201

Tooth Number	8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
	8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Figure 2: Is questionnaire which has been used for 5th grade.

Composite risen which has been used

Figure 3: 3M ESPE Composite risen.

Flowable Composite which has been used

Figure 4: Charisma Flowable Composite.

Etching Material which has been used

Figure 5: Travlin Gel For Etching.

Bonding material which has been used

Figure 6: Bond 2.1 Bonding.

Amalgam material which has been used

Figure 7: Ardent future high cupper non gamma-2 alloy.

Examples about Bitewing radiograph

Figure 8: X ray Bitewing radiograph.

EasyDentV4

Figure 9: EasyDentV4**.**

Results

Data of table 1, show that more than half of clinicians were students from fifth grade (53.8%) while less than half of them are fourth grade students. 63.1% of participants are male, while only 47.5% were male clinicians. 53.8% of tooth are of premolar type, 59.4% are of distal variety regarding the side of restoration. 52.5% of tooth are located in the upper jaw. Majority (84.4%) of patients undergoing composite type of restoration. The prevalence of overhang was 20% but prevalence of gap was about quarter (25.6%).

Measures	Categories	Frequency	Percent
Grade	Fourth	74	46.3
	Fifth	86	53.8
Gender of participant	Male	101	63.1
	Female	59	36.9
Gender of clinician	Male	76	47.5
	Female	84	52.5
Type of tooth	Molar	74	46.3
	Premolar	86	53.8
Side of restoration	Mesial	65	40.6
	Distal	95	59.4
Location of tooth in jaw	Upper	84	52.5
	Lower	76	47.5
Type of restoration	Amalgam	25	15.6
	Composite	135	84.4
Prevalence of overhang	Yes	32	20
	No	128	80
Prevalence of gap	Yes	41	25.6
	No	119	74.4
	Total	160	100

Table 1: Descriptive data and prevalence of overhang and gap among participants.

Tables: Associations between overhang and different parameters

There is statistically significant association between overhang and the following parameters: gender of clinician, type of tooth and type of restoration. Chi square test was done and P-values were less than 0.05. In contrary there were statistically non-significant relationships between the formation of overhang and the following measures: student's grade, gender of patient, location of tooth in jaw and side of restoration. Chi square test was done to find out the relationship and P-values were more than 0.05.

Gender of clinician	Overhang		Total
	Yes	No	
Male	10	66	76
	31.3%	51.6%	47.5%
Female	22	62	84
	68.8%	48.4%	52.5%
Total	32	128	160
	100.0%	100.0%	100.0%

Table 2: Associations between overhang and gender of clinician.

P: 0.04.

Type of tooth	Overhang		Total
	Yes	No	
Molar	23	51	74
	71.9%	39.8%	46.3%
Premolar	9	77	86
	28.1%	60.2%	53.8%
Total	32	128	160
	100.0%	100.0%	100.0%

Table 3: Associations between overhang and Type of tooth.

P: 0.001.

Type of restoration	Overhang		Total
	Yes	No	
Amalgam	13	12	25
	40.6%	9.4%	15.6%
Composite	19	116	135
	59.4%	90.6%	84.4%
Total	32	128	160
	100.0%	100.0%	100.0%

Table 4: Associations between overhang and Type of restoration.

P: 0.001.

Grade	Overhang		Total
	Yes	No	
4th grade	16	58	74
	50%	45.3%	46.3%
5th grade	16	70	86
	50%	54.7%	53.8%
Total	32	128	160
	100%	100%	100%

Table 5: Associations between overhang and Grade.

P: 0.63.

Gender of patient	Overhang		Total
	Yes	No	
Male	18	83	101
	56.3%	64.8%	63.1%
Female	14	45	59
	43.8%	35.2%	36.9%
Total	32	128	160
	100.0%	100.0%	100.0%

Table 6: Associations between overhang and Gender of patient.

P: 0.36.

Location of tooth in Jaw	Overhang		Total
	Yes	No	
Upper	14	70	84
	43.8%	54.7%	52.5%
Lower	18	58	76
	56.3%	45.3%	47.5%
Total	32	128	160
	100.0%	100.0%	100.0%

Table 7: Associations between overhang and Location of tooth in Jaw.

P: 0.26.

Side of restoration	Overhang		Total
	Yes	No	
Mesial	15	50	65
	46.9%	39.1%	40.6%
Distal	17	78	95
	53.1%	60.9%	59.4%
Total	32	128	160
	100.0%	100.0%	100.0%

Table 8: Associations between overhang and Side of restoration.

P: 0.42.

Figure 10: Overhang Restoration in upper right 2nd premolar distally.

Tables: Association between gap formation and different measures

There is statistically significant association between gap formation and the following parameters: location of tooth in jaw and side of restoration and type of restoration. In all conditions Chi square test was done and P-values were less than 0.05. In opposite to that there were statistically nonsignificant relationships between the gap formation and the following measures: student's grade, gender of patient, gender of clinician and type of tooth. Chi square test was done to find out the relationship and P-values were more than 0.05.

Location of tooth in jaw	Gap		Total
	Yes	No	
Upper	14	70	84
	34.1%	58.8%	52.5%
Lower	27	49	76
	65.9%	41.2%	47.5%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 9: Association between gap formation and Location of tooth in Jaw.

P: 0.006.

Side of restoration	Gap		Total
	Yes	No	
Mesial	11	54	65
	26.8%	45.4%	40.6%
Distal	30	65	95
	73.2%	54.6%	59.4%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 10: Association between gap formation and Side of restoration.

P: 0.03.

Type of restoration	Gap		Total
	Yes	No	
Amalgam	2	23	25
	4.9%	19.3%	15.6%
Composite	39	96	135
	95.1%	80.7%	84.4%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 11: Association between gap formation and Type of restoration.

P: 0.02.

Grade	Gap		Total
	Yes	No	
4th grade	15	59	74
	36.6%	49.6%	46.3%
5th grade	26	60	86
	63.4%	50.4%	53.8%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 12: Association between gap formation and Grade.

P: 0.15.

Gender of patient	Gap		Total
	Yes	No	
Male	28	73	101
	68.3%	61.3%	63.1%
Female	13	46	59
	31.7%	38.7%	36.9%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 13: Association between gap formation and Gender of patient.

P: 0.42.

Gender of clinician	Gap		Total
	Yes	No	
Male	24	52	76
	58.5%	43.7%	47.5%
Female	17	67	84
	41.5%	56.3%	52.5%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 14: Association between gap formation and Gender of clinician.

P: 0.10.

Type of tooth	Gap		Total
	Yes	No	
Molar	19	55	74
	46.3%	46.2%	46.3%
Premolar	22	64	86
	53.7%	53.8%	53.8%
Total	41	119	160
	100.0%	100.0%	100.0%

Table 15: Association between gap formation and Type of tooth.

P: 0.98.

Figure 11: Restoration with Gap formation in lower Left 1st molar distally.

Figure 12: Grades of students.

Figure 13: Gender of patient.

Figure 14: Type of tooth.

Figure 15: Side of restoration.

Figure 16: Gap.

Figure 17: Gender of clinician.

Figure 18: Location of tooth in Jaw.

Figure 19: Type of restoration.

Figure 20: Overhang.

Discussion

This study concentrates on the prevalence of overhang and gap formation in posterior amalgam and composite restorations.

In our study, according to the site of the restoration occurrence of overhang was (46.9%) on mesial side and on distal side was (53.1%), with no statistical significant difference at p 0.42; this result was in accordance with [11] that found more than half (57.3%) of the overhanging margins in class II were distal and (42.7%) were on mesial surface at $p < 0.05$, also in accordance with [16] that found the occurrence of overhang was more frequent on distal surfaces (56%) with significant difference at $p < 0.0001$. Our result was in contrast to [17] that found overhang on mesial surface was (36.4%) and on distal surface was (64.61%).

Total overhang result in this study in the upper jaw was (43.8 %) and in the lower jaw was (56.3 %) with non-significant difference relationships between formation of overhang and location of the tooth in the jaw at $p < 0.26$, this was in contrast with [11] where the frequency of overhang in maxilla was significantly higher (60.4%) than that of mandible (39.6%) at $p < 0.05$, and our result is in contrast with [17] where the distribution of overhang was (59.4%) for upper teeth and (40.6%) for lower teeth, also our study was in contrast with [18] that found significant difference between maxilla and mandible (71.29%) respectively. Also, our result was in contrast with [19] that found the highest amount of overhang was in upper jaw (42.5%).

According to the type of tooth, our study revealed that total overhang formation in molar was (71.9%) and in premolar was (28.1%) with significant difference at p 0.001, this result was in agreement with [11] where the frequency of overhang restorations in molar teeth (82.9%) was significantly higher than that of premolar teeth at $p < 0.05$ and it is in contrast with [18] that found no significant difference in prevalence of overhanging amalgam restorations between molars (43%) and premolars (57%).

Our study revealed overhang amalgam restoration was more prevalent in molar (7%) and which is significant and much more than that of [19] that found overhang frequency rate was higher in first molar (50%), also our result was much more than [11] where the most frequent overhang restorations were in the maxillary

molars (49.6%) and the least frequent were in premolar teeth of mandible (6.4%).

According to our study, (20%) of all surfaces that have been restored show presence of overhang, this result was much lower than [17] that found the prevalence of amalgam overhang was (25.4%) these differences in results of the two studies could be attributed to difference in the number of sample size and sampling technique.

Many previous research approved that overhang amalgam filling had a destructive effect on tooth supporting structures, a high statistical correlation has been reported among incorrect restoration margins a periodontal disease and the reduction in bone height [20].

In our study, the prevalence of overhanging amalgam restoration was (40.6%) which was much lower than that of [21] as 50% of posterior teeth showed overhang, also with [22] that (51%,) of posterior amalgam restorations showed overhanging margin which is the main result of overhanging margins and also lower than that of [23] where (57%) of patients had overhang.

Our result was in accordance with [24] where the prevalence of overhang was (49.8%) which was the destructive factor for tooth supporting structures and also in accordance with [25] which revealed a strong correlation between increase bone loss with overhang filling.

Our study revealed that the highest amount of overhang in the upper jaw was (43.8%), it is in accordance with [19] (42.5%) and with [24] (49.8%) where the prevalence of overhang more frequently happened in upper molars with bone loss, these differences may be due to differences in sample size and methods of measurement. Also, the differences could be attributed to the fact that the present sample was obtained from Tishik Dental College where all procedures are expected to be closely supervised by dental faculty.

Gap formation

In our study, prevalence of gap formation was (25.6%) of restorations, while (74.7%) were free from gap formation.

In Tishik dental clinic/conservative department, mostly high viscous composite is used for class II restoration, this result is in contrary to [26,27] who demonstrated that polymerization contraction values and gap formation was similar to the conventional resin composite, also our result was in contrast with [28] where silorane-based composite showed better marginal adaptation due to low viscosity and in contrast with [29] where Bulk-Full showed better adaptability and less gap formation than incremental composite.

Another reason for increasing gap formation is deficiency of doing beveling around composite restoration in undergraduate course in Tishik University, this finding supports the result of [30] that the use of a bevel results in improved marginal adaptation and reducing the impact of long-term storage on restoration quality [30].

Concerning the relationship between formation of overhang and gender, our study revealed nonsignificant difference between the total number of patients with the occurrence of overhang in male (56.3%) and female (43.8%), this result was in accordance with [19].

According to this study (20%) of all surfaces that have been restored show presence of overhang while (80%) were free from overhang. In relation to the formation of gap (25.6%) of restorations have gap and (74.4%) were free from gap.

Conclusion and Suggestions

Conclusion

According to this study (20%) of all surfaces that have been restored show presence of overhang while (80%) were free from overhang. In relation to the formation of gap (25.6%) of restorations have gap and (74.4%) were free from gap.

Suggestions

- Further studies are needed for investigating incidence of overhang and gap formation in post graduate students and specialists.
- Further studies must be done with selected samples for the period of time to know the improvement level of students between 4th and 5th grade, and to determine the cause of poor improvement of their skills.

- Operative course is needed to give 5th grade in order to help them to know different types of bands, wedges, retainers and how to use and also where to use them.

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