

# Evaluation of presence of proximal contacts on recently inserted posterior crowns in different health sectors in Riyadh City, Saudi Arabia

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## ABSTRACT

**Background:** For the successful outcome of the rehabilitation of the teeth with crown, the proximal contact points play a significant role hence the aim of the present study was to evaluate the presence of proximal contacts on recently inserted crowns in posterior teeth. **Methods and Materials:** The cross-sectional study was conducted on recently inserted posterior crowns. Clinical assessment of proximal contact points on crowns was made with dental floss, the floss was wrapped around the index fingers of both hands and was passed through the crowns mesial and distal contact points and was categorized as acceptable, open contact points, and tight contact points. **Results:** In the present study 401 crowns were examined to assess proximal contacts on 788 proximal surfaces. It was found that 522 (66.2%) crowns were in normal proximal contact, 144 (18.3%) showed open proximal contacts, 122 (15.5%) showed tight proximal contacts. **Conclusion:** Regarding the assessment of proximal contacts, the study showed that a significant number of crowns had open or tight proximal contacts. Specialists and residents were able to perform better in providing the optimum proximal contacts.

**Keywords:** Crowns, dental floss, proximal contact

## Introduction

Interproximal contact area has been defined as the area of a tooth that is in close association, connection, or contact with an adjacent tooth in the same arch.<sup>[1]</sup> The ideal proximal contacts in natural teeth and restorations are important factor for the health and longevity of the dento-alveolar complex.<sup>[2]</sup>

The size, location, and shape of the proximal contact areas depend on the anatomical surface contours of the two adjacent proximal surfaces, and whether they are on the mesial or distal aspects of the teeth. A well-contoured, properly positioned,

firm proximal contact may protect the gingival tissues and tend to clean the adjoining surfaces.

Interproximal contact tightness is affected by several factors including, the location of the teeth in the jaws, diurnal variations, patient position, occlusion, and para-functional habits.<sup>[3,4]</sup> Too tight contacts can result in wedging of the teeth, damaging the periodontal tissue, cause undesirable tooth movement or interfere with the physiological displacement of the teeth. Loose or open proximal contact can result in periodontal pocket formation, calculus deposition, ill-fitting margins of dental restorations, proximal carious lesions, food impaction, and plunger cusp.<sup>[5,6]</sup>

Each tooth has a danger area just below its proximal contact point where food can accumulate leading to interproximal caries.<sup>[7]</sup>

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Therefore, maintaining the proper proximal contact in natural dentition and in tooth restorations is essential.<sup>[8-12]</sup>

When restoring the proximal contact area, consideration should be given to the size of the contact area and to other factors like the DMF index of the individual, oral hygiene, and firmness of the contact, which influences the recurrence of caries around the contact area. An average-sized well-contoured firm proximal contact supplemented by good oral hygiene and caries preventive measures in patients with high DMF indices should assure the permanence of restorations.<sup>[13,14]</sup>

At rest, proximal contact tightness is less in the maxilla than in the mandible, whereas during clenching it is less in the mandible. However, teeth are displaced when the jaw is in function and this temporary displacement may affect the state of proximal contact. Excessive occlusal forces through improper proximal contacts can result in undesirable forces on the periodontium.<sup>[15,16]</sup>

The most widely used method to evaluate interproximal contacts is to pass dental floss between contact areas. The closeness of the proximal contacts surfaces between the teeth should be adequate in order to allow the dental floss to pass, with some resistance, between the adjacent teeth.<sup>[17]</sup> The optimal tightness of the proximal contact was defined as a “snap” as the floss passed through the contact point.<sup>[18]</sup>

To our knowledge there are only few researches done in this area, the study done by Akhtar *et al.* in 2015<sup>[18]</sup> and Ahmad Z in 2011<sup>[19]</sup> observed the proximal contact points on adjacent natural teeth using dental floss. Hence, the aim of this cross-sectional study was to assess the presence of proximal contacts among recently inserted posterior crowns.

## Material and Methods

Study proposal was submitted and formal approval for the study was obtained with institution review board number RC/IRB/2018/1214 (16/10/2018). The study was carried out in different health sectors in Riyadh city, Saudi Arabia randomly on patients with crowns, no more than 3 months after insertion. Only crowns on posterior teeth were evaluated. The crowns were categorized based on whether they were provided by a student, general practitioner, resident or restorative/prosthodontics specialist. Each participant was explained about the study and an informed consent was procured.

To avoid clinician bias a few precautions were taken. Only one crown was chosen for each clinician and in case of multiple crowns only one crown was chosen for assessment with the most recent and most posterior one. Only one crown per patient per clinician was chosen. The clinician was not provided with any information regarding the aims and objectives or the procedure of the study, so as to avoid them from presenting cases that were provided with precautions taken by them to meet the norm.

Sampling was done randomly and not by recall of patients based on previous radiographs or database.

The sample size was calculated using the G-power sample size calculator; considering 95% sample power. Based on this the required sample size was 386. Data were collected from 401 individuals. The sample size was on 401 unit crowns delivered by 401 clinicians on both male and female patients. The total proximal surfaces were 788 surfaces. In the mesial proximal contact, there were 401 proximal surfaces, 286 (71.3%) were in normal contact, 53 (13.2%) were in open contact and 62 (15.5%) were tight contact. Regarding to the distal surface there were 387 proximal surfaces, the normal proximal contact was 236 (61%), open proximal contact was 91 (23.5%) and 60 (15.5%) were tight proximal contact.

Inclusion criteria was recently inserted crowns within 3 months (to be checked), with both mesial and distal contacts, Normal tooth alignment (of the adjacent and the tooth to be examined), Adjacent tooth with normal morphology (irrespective of whether it was natural enamel, restorative composite resin, or prosthetic crown), Mesial and distal contacts were assessed, and each were considered one surface. Exclusion criteria was drifting, rotation or supra-eruption (of the adjacent and the tooth to be examined), Chipping of porcelain (of the adjacent and the tooth to be examined), Broken down adjacent teeth, Grade II or III mobility (of the adjacent and the tooth to be examined), Cases who recently finished orthodontic treatment.

Clinical assessment of proximal contact points on crowns was made with Colgate Waxed Dental Floss (Colgate 300 Park Avenue; New York, NY). The floss was wrapped around the index fingers of both hands and was passed through the crowns contact points and was categorized as acceptable, open contact points and tight contact points. Acceptable contact points were considered if dental floss could be passed with little resistance. Open contact points were those, which allowed the dental floss to pass without resistance. If dental floss shredded or could not be passed, it was categorized as tight contact points. The data was collected on a structured proforma.

After checking the proximal contact, data was collected to whether the crown was provided by a student, general practitioner, resident or restorative/prosthodontic specialist. This data was allocated with the finding of proximal contact to check who can do better work in placing the correct proximal contacts on the crowns.

The Statistical Package for the Social Sciences (SPSS for Windows, version 24.0) (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The difference between the presence and location of proximal contacts and between the dentists' level of education, years of experience, workplace, site (teeth), site (arch), and crown type was tested with *Chi-square test*. Levels of  $P \leq 0.005$  was considered to be statistically significant.

## Results

The present study involved the clinical assessment of 401 crowns focused on the work of the clinicians, the crown was provided by 401 clinicians, of which there were 33 (8.2%) students, 256 (63.8%) general practitioner, 57 (14.2%) residents, and 55 (13.7%) restorative/prosthetic specialists. Two hundred eighteen (54.4%) clinician had less than 5 years of experience, while 151 (37.7%) had 5 to 10 years of experience and 32 (8%) clinician had more than 10 years of experience. One hundred forty-six (36.4%) of those clinicians were working in the government sector, 122 (30.4%) were working in the private sector and 133 (33.2%) were working in college or universities [Table 1].

Out of the 401 crowns assessed, 243 (60.6%) were in the maxillary arch and 158 (39.4%) were in the mandibular arch. Two hundred one (50.1%) were in the premolar and 200 (49.9%) were in a molar. One hundred twenty-one (30.2%) were PFM crowns, 55 (13.7%) were Lithium disilicate crowns and 225 (56.1%) were zirconia crowns [Table 2].

In the present study, 401 crowns were examined leading to the assessment of proximal contacts on 788 proximal surfaces (as some of the examined crown had only one adjacent tooth in either side mesial or distal). Out of those 788 proximal surfaces, it was found that 522 (66.2%) showed optimum proximal contacts, 144 (18.3%) showed open proximal contacts, 122 (15.5%) showed tight proximal contacts [Graph 1].

**Table 1: Frequency distribution of the demographic data of dentists**

Variables	Frequency	Percentage	
Level of education	Students	33	8.2
	General practitioner	256	63.8
	Resident	57	14.2
	Restorative/prosthetic specialist	55	13.7
Dentists Years of experience	< 5 years	218	54.4
	5 to 10 years	151	37.7
	> 10 years	32	8.0
Workplace	Government	146	36.4
	Private	122	30.4
	College or university	133	33.2

**Table 2: Frequency distribution in relation to Site (arch and teeth) and Crown type**

Variables	Frequency	Percentage	
Site (arch)	Maxillary	243	60.6
	Mandibular	158	39.4
Site (teeth)	Premolar	201	50.1
	Molar	200	49.9
Crown type	PFM	121	30.2
	Lithium disilicate	55	13.7
	Zirconia	225	56.1

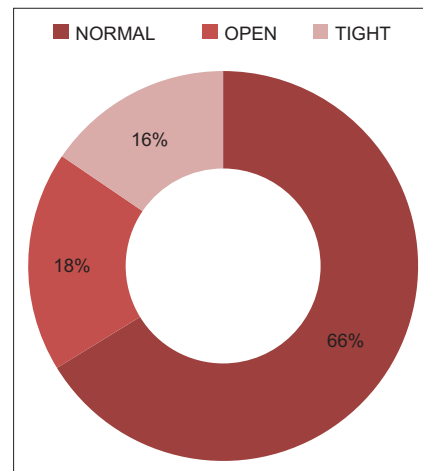
When assessing the link between level of education and years of experience of the clinicians, the study showed statistically significant differences as the clinicians with more years of experience, residents, and restorative/prosthetic specialists performed better in establishing the presence of proximal contact. When assessing the crowns provided in different sectors (Government, Private and College or University), the study showed statistically significant differences in regard to the presence of the proximal contacts, highlighting that the clinician working in the College or University performed better than others [Table 3].

In a comparison of the presence of proximal contacts of crowns that were made in the maxilla and the mandible, the study showed no statistically significant differences. When comparing the crowns made in molar and premolar teeth, there were statistically significant differences, showing crowns on premolar were better in normal proximal contacts. When it comes to the type of crowns, the study showed statistically significant differences as Lithium Disilicate crowns performed better in establishing the proximal contacts compared to PFM and Zirconia crowns [Table 4].

## Discussion

A healthy dentition comprises of fully erupted teeth with proper occlusal and proximal contacts that help to stabilize and maintain the integrity of the dental arch.<sup>[20]</sup> The form of a contact point and the area in which it is placed, both bucco-lingually and occluso-gingivally, is extremely important for a perfectly equalized arch.<sup>[17]</sup> A well-contoured, properly positioned, firm proximal contact may protect the gingival tissues and tend to clean the adjoining surfaces, thereby preventing the occurrence of caries.<sup>[12-17]</sup>

Open proximal contact can contribute to the periodontal pocket formation, Gingival recession/inflammation, calculus deposition, proximal carious lesions, food impaction, shifting of teeth (mesial



**Graph 1:** Total proximal contact recorded as normal, open, and tight contact

**Table 3: Comparison proximal contact presence with dentist's level of education, years of clinical experience and workplace**

Parameters	Proximal contact presence			P
	Normal	Open	Tight	
Education				
Students	43 (65.2%)	15 (22.7%)	8 (12.1%)	<0.001
GPS	307 (60.0%)	110 (21.5%)	95 (18.6%)	
Residents	86 (86.0%)	14 (14.0%)	0 (0.0%)	
Restorative/ prosthodontics specialist	86 (78.2%)	5 (4.5%)	19 (17.3%)	
Experience				
<5 Years	274 (63.1%)	72 (16.6%)	88 (20.3%)	<0.001
5-10 Years	200 (68.0%)	62 (21.1%)	32 (10.9%)	
> 10 Years	48 (80.0%)	10 (16.7%)	2 (3.3%)	
Workplace				
Government	202 (69.2%)	56 (19.2%)	34 (11.6%)	<0.001
Private	128 (52.5%)	52 (21.3%)	64 (26.2%)	
College/University	192 (76.2%)	36 (14.3%)	24 (9.5%)	

P≤0.005

**Table 4: Comparison proximal contact presence with dental arch, teeth, and crown type**

Parameters	Proximal contact presence			P
	Normal	Open	Tight	
Dental arch				
Maxillary	334 (70.2%)	77 (16.2%)	65 (13.7%)	0.016
Mandible	188 (60.3%)	67 (21.5%)	57 (18.3%)	
Teeth				
Premolar	294 (73.1%)	50	58 (14.4%)	<0.001
Molar	228 (59.1%)	94 (24.4%)	64 (16.6%)	
Crown type				
PFM	124 (52.3%)	65 (27.4%)	48 (20.3%)	<0.001
Lithium Disilicate	83 (75.5%)	7 (6.4%)	20 (18.2%)	
Zirconia	315 (71.4%)	72 (6.3%)	54 (12.2%)	

P≤0.005

drift), and faulty occlusion.<sup>[5,21,22]</sup> The teeth with open or poorly shaped contacts had significantly higher Periodontal Index scores when compared with teeth that had sound proximal contacts.<sup>[5]</sup> The crowns with too tight proximal contacts can damage the periodontal tissue or cause improper tooth movement or interfere with the physiological displacement of the teeth and cause wedging of the teeth.<sup>[4,9]</sup>

In the present study after assessing 788 proximal contact surfaces, we found 522 (66.2%) in normal proximal contact, 144 (18.3%) in open proximal contact, and 122 (15.5%) in tight proximal contact, the results are similar with the study done by<sup>[2]</sup> in the normal and tight proximal contacts they found (in the 142 proximal contacts surfaces) 83 (58.4%) were normal and 18 (12.6%) were tight proximal contacts with a small difference in the open contacts where they found 41 (28.8%) open proximal contacts.

In the present study from 788 mesial and distal proximal contacts we found, normal proximal contacts on 286 (71.3%) mesial

surface and normal 236 (61%) on distal surface, open contacts on 53 (13.2%) mesial surfaces and 91 (23.5%) on distal surface, tight contacts on 62 (15.5%) mesial surfaces and 60 (15.5%) on distal surfaces. Comparing the present study with the study by<sup>[19]</sup> where they assessed the presence of proximal contacts on mesial and distal surfaces and found normal contact points were present on mesial surfaces in 51 (56.7%) and 24 (34.8%) were on distal surfaces of the crowns; Open contacts were observed on mesial surfaces in 16 (17.8%) and 20 (29%) were on distal surfaces. In their study tight contact points were observed in 14 (15.6%) on mesial surfaces and 20 (29%) on the distal surfaces of crowns. The present study showed higher values in areas of normal mesial and distal contacts and tight distal contacts, while the present study showed similar value in area of open mesial and distal contacts and tight mesial.

When assessing the parameter of level of education and years of experience of the clinicians, the study showed that with more years of experience residence and specialists performed better in establishing the presence of proximal contact, still showing statistically significant results.

The present study showed statistically significant in comparing the presence and location of proximal contacts with the crown type, as it shows Lithium disilicate crowns performed better in regard to the ability of clinician to establish proper proximal contact than PFM and Zirconia crowns.

The present study, as with any research, is not without limitations. Only single crowns on natural teeth were assessed, thereby omitting the assessment of clinician prowess in establishing proximal contacts in FPDs. The study was conducted in an urban setup; the influencing factors in a rural setup were not assessed or compared.

The best possible proximal contacts during crown position positively affect the life span of the tooth. It avoids further aggravation of the gingiva, proper contacts between the crowns helps appropriate progression of spit and sustenance and averts event of torment and disappointment of prosthesis.

## Conclusion

From the present study it was concluded that many of the crowns placed had open contacts or tight contacts and these acts as the potential areas for food accumulation and bacterial growth. All these factors reduce the possibility of crown placed without any complications for longer periods. The services rendered by Specialist and the resident doctors in the present study were found to be better as compared to others.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients

understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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