

## **Complications Associated with Fixed Prosthodontics in a Population Presenting for Treatment to a Dental School in Jeddah, Saudi Arabia**

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*Abstract.* Evaluating the types of fixed partial denture failure has a great importance in educating general dentists and laboratory technicians. The objective of this study is to determine complications associated with fixed partial denture and to examine the effect of service duration as well as the number of units on prevalence of these complications in the selected samples. Seventy five patients contributing a total of 309 units were included. Qualities of the present fixed partial dentures were clinically and radiographically assessed. Descriptive statistics and chi-square were used for data analyses. The results showed most common complication was shade mismatch 64%, over-contoured 59.9%, open margins 49.8% and caries 40.1%. The number of units and duration of service were found to influence most of the assessed complications. The prevalence of complications was high among the studied sample. An effective method to control dental disease and improve dental awareness in Saudi Arabia is recommended.

*Keywords:* Failure, Prosthodontic, Complications, Survival, Saudi Arabia.

### **Introduction**

Despite the increased popularity of dental implants, conventional crowns and bridgeworks make up a major element of general and prosthodontic dental practice, especially in developing countries. It is important

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therefore, to evaluate success and the survival of the constructed restorations as well as causes and types of complications plus failures associated with these prostheses. Comprehension of these factors will improve the clinician's ability to plan the most suitable treatment, provide patients with realistic expectations and formulate an appropriate maintenance regime for patients with fixed prostheses<sup>[1-3]</sup>.

A few meta-analyses were conducted in order to combine results of different studies and to better estimate the achievement and endurance of fixed prostheses<sup>[1-7]</sup>. Scurria *et al.* estimated the survival rates of fixed prostheses to be 92% and 75% at 10 and 15 years, respectively when failure was defined as fixed prostheses removal<sup>[7]</sup>. These rates, however, decreased to 87% and 69% at 10 and 15 years, respectively, when failure was defined as prosthesis removal and/or technically failed, thus needed replacement. Failure and complications associated with fixed prostheses include, but not limited to the loss of retention, caries, endodontic complications, periodontal disease, tooth fracture or porcelain fracture, and unsatisfactory esthetics of the prosthesis<sup>[2-7]</sup>.

Although several studies had examined failure and complications associated with fixed prostheses, this topic has not been adequately investigated in Saudi Arabia<sup>[8-27]</sup>. Hence, this study was undertaken as; 1.) To determine prevalence of complications associated with single crowns and fixed partial dentures (FPDs) among a population of dental school patients in Saudi Arabia. 2.) To examine the effect of service duration on prevalence of these complications. 3.) To compare prevalence of complications associated with single crowns and 3 units fixed partial dentures. The null hypothesis of the study was that complications of fixed partial dentures among non Saudi population will be comparable to other previously reported complications.

### **Materials and Methods**

A total of 76 patients (age range of 18-82 years, 40 of the participants were females and 36 males) with 309 FPD and single crown were selected from the dental clinic at King Abdulaziz University, Faculty of Dentistry. All patients were non Saudi and lived in Jeddah, Saudi Arabia. Patients with at least 3 units fixed partial denture or a single crown with the presence of natural contra-lateral tooth / teeth were included. All prostheses were performed and inserted by several general

dental practitioners in Jeddah with a minimum of one year service duration. None of these patients were enrolled in regular recall visits for professional maintenance and none of their fixed prostheses were repaired previously. Patients were informed and written consents were obtained under a protocol reviewed and approved by the Bioethical and Research Committee of King Abdulaziz University, Jeddah, Saudi Arabia. Age, gender and the time of prostheses placement were recorded. Complete clinical and radiographic examinations were conducted by two general dentists. Primary impressions were made and study casts were constructed and mounted. Quality of the present fixed prostheses was assessed in regard to presence of any of the following:

1. Recurrent marginal decay was assessed clinically by penetration of sharp dental explore or radiographically, as presence of radiolucent area on bitewing or periapical X-ray films for posterior and anterior abutments, respectively.

2. Overhangs or open margins were assessed clinically by tactile examination using sharp dental explorer or radiographic examinations.

3. Over-contoured restorations was assessed by comparing the mesio-distal and bucco-lingual dimensions to the normal contra-lateral tooth on the diagnostic cast.

4. Shade mismatch was assessed visually under a day light condition.

5. Porcelain veneer or abutment fracture was assessed visually.

6. Occusal interferences were assessed in centric and lateral excursion on mounted study casts.

7. Looseness of the prostheses.

8. Periodontal disease was assessed by measuring probing depths and clinical attachment loss on 6 sites per each tooth. Presence of 5 mm or more of clinical attachment was used as the cutoff point.

9. Gingival bleeding was assessed by walking a periodontal probe 2 mm into sulci of the abutment teeth.

10. Periapical conditions of the abutment tooth were assessed by radiograph.

11. Occlusal wear of the opposing tooth was assessed visually on diagnostic cast.

12. Pain and or discomfort associated with the fixed prostheses.

Statistical analysis was conducted using a Statistical Package for Social Science (SPSS, version 16, SPSS Inc. Chicago, IL, USA). Descriptive statistics, including means and standard deviations were calculated for continuous variables, frequency and percentage for categorical variables, were calculated. Pearson's chi-square test was performed to examine the association between complications prevalence as well as the type of prostheses and serviceability time ( $\alpha = 0.05$ ).

## Results

The study participants had a mean age of 45.6 years. The mean and median length of time in service of the prostheses was 8.8 and 7 years, respectively.

Prevalence of complications and/or failures of fixed prostheses are presented collectively in Table 1.

**Table 1. Prevalence of complications associated with fixed prostheses in the total sample.**

<b>Complications</b>	<b>n</b>	<b>%</b>
Shade mismatch	199	64.4
Over-contoured	185	59.9
Open Margin	154	49.8
Caries	124	40.1
Periodontal disease	116	37.5
Gingival bleeding	105	34.0
Overhangs	85	27.5
Fractured Porcelain	59	19.1
Looseness	49	15.9
Pain / Discomfort	48	15.5
Periapical lesion	33	10.7
Occlusal Wear	8	2.6
Abutment fracture	0	0.0
<b>Total Units(Single crown and FPD)</b>	<b>309</b>	<b>100</b>

*Categories are not exclusive, a single crown or FPD may have more than one complication.*

The most common complication was the shade mismatch (64.4%) followed by prostheses over-contoured (59.9%). About 50% and 40% of the units had open margins and caries, respectively. Prevalence of caries was significantly higher in teeth with open margins prostheses than those without ( $p < 0.001$ ), as shown in Fig. 1.

Nearly 16% of the prostheses were loose. The least frequent complication was occlusal wear of the opposing tooth (2.6%). Table 2, shows prevalence of complications stratified by whether the prostheses are single or a 3 units fixed partial denture.

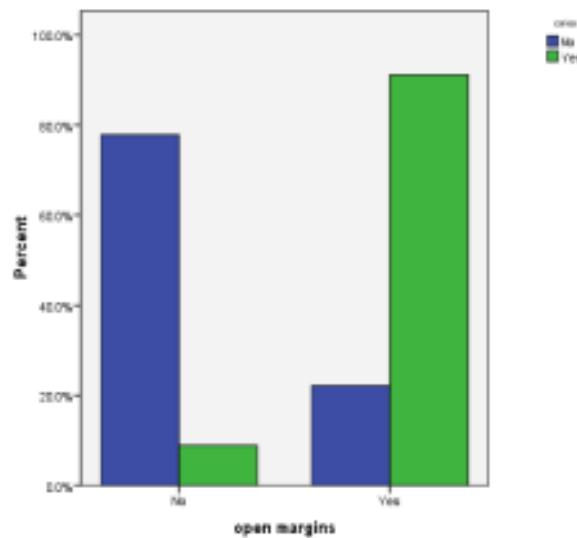


Fig. 1. Percentage of abutments with and without caries around prostheses with and without open margins.

Table 2. Prevalence of complications stratified by type of prostheses.

Complications	3-Unit Fixed Partial Denture		Single Crowns		P-value
	N	%	N	%	
Shade mismatch	146	62.7	53	69.7	0.26
Over-contoured	161	69.1	24	31.6	0.01
Open Margin	126	54.1	28	36.8	0.01
Caries	108	46.4	16	21.1	0.01
Periodontal disease	84	36.1	32	42.1	0.34
Gingival bleeding	93	39.9	12	15.8	0.01
Overhang	75	32.2	10	13.2	0.01
Fractured Porcelain	41	17.6	18	23.7	0.24
Looseness	42	18.0	7	9.2	0.07

Pain / Discomfort	33	14.2	15	19.7	0.24
Periapical lesion	28	12.0	5	6.6	0.18
Occlusal Wear	8	3.4	0	0.0	0.21
<b>Total Units (Single Crown &amp; FPD)</b>	<b>233</b>	<b>75.4</b>	<b>76</b>	<b>24.6</b>	<b>—</b>

*Categories are not exclusive, a single crown & FPD may have more than one complication.*

Caries, gingival bleeding and prostheses with overhang; overcontoured and/or open margins were significantly more common for the 3-unit fixed partial denture than for single crowns ( $p < 0.001$ ). The other complications were not significantly different between single crown and the 3-unit fixed partial denture.

The effect of service duration on the rate of complications is shown in Table 3.

**Table 3. The effect of service duration on the prevalence of complications.**

Complications	≤ 5 years		6-10 years		11-15 years		> 15 years	
	N	%	N	%	N	%	N	%
Shade mismatch <sup>†</sup>	92	68.7	29	44.6	11	29.7	67	91.8
Over-contoured*	82	61.2	45	69.2	24	64.9	34	46.6
Open Margin <sup>†</sup>	49	36.6	38	58.5	26	70.3	41	56.2
Caries <sup>†</sup>	28	20.9	38	58.5	13	35.1	45	61.6
Periodontal disease <sup>†</sup>	21	15.7	16	24.6	25	67.6	54	74.0
Gingival bleeding <sup>†</sup>	36	26.9	21	32.3	31	83.7	17	23.3
Overhang <sup>†</sup>	41	30.6	16	24.6	21	56.8	7	9.6
Fractured Porcelain	26	19.4	11	16.9	10	27.0	12	16.4
Looseness <sup>†</sup>	0	0.0	5	7.7	13	35.1	31	42.5
Pain / Discomfort <sup>†</sup>	28	20.9	14	21.5	2	5.4	4	5.5
Periapical lesion <sup>†</sup>	4	3.0	11	16.9	7	18.9	11	15.1
Occlusal Wear <sup>†</sup>	0	0.0	0	0.0	7	18.9	1	1.4
<b>Total Units(Single Crown and FPD)</b>	<b>134</b>	<b>43.4</b>	<b>65</b>	<b>21.0</b>	<b>37</b>	<b>12.0</b>	<b>73</b>	<b>23.6</b>

*The difference between groups is statistically significant at \* $p < 0.05$ ; <sup>†</sup> $p < 0.01$ .*

About 56% and 62% of the prostheses that were in place for more than 15 years, respectively, had open margins and caries; whereas only

less than 37% and 21% of those that were in service for 5 years or less had open margins and caries, respectively. Periodontal breakdown also increased with increased service duration. Pain and discomfort were more common in prostheses with shorter service duration. Porcelain fracture was not associated with service duration ( $p = 0.57$ ).

### Discussion

The current study data rejected the null hypothesis that there was no difference in the complications of fixed partial denture among the selected population when compared to other previously reported complications. This study investigated complications associated with fixed prostheses among a population of dental school patients in Saudi Arabia as well as to examine the effect of service duration and number of units on the prevalence of these complications. Previous reported data from different studies was used for comparison purpose (control group) due to our inability to obtain initial data at the time of prostheses insertion. The most common problems associated with the fixed prostheses in the present study were shade mismatch, prostheses over-contoured, open margins and caries. The prevalence of complications in this study is higher than that reported in previous studies<sup>[8-27]</sup>. An unsatisfactory esthetic result was observed in more than 60% of the prostheses in the present study; whereas a prevalence of 6% was found in a recent meta-analysis<sup>[3]</sup>. These findings could be explained by the condition in which the shade was selected. All shades were selected without using the correct light system as reported by the treating dentists. In addition, all of the examined prostheses were porcelain fused to metal and the shade could be altered by the opaque porcelain that masks the metal color.

In the current study, about 40% of the abutments were affected with caries whereas only 18% of abutments were affected, as reported by Goodacre and colleagues<sup>[3]</sup>. Prevalence of caries was higher for FPD as compared to single crowns and the prevalence increased with increasing time since restorations placement. These findings are consistent with results of other studies<sup>[3,7,27]</sup>. Periodontal disease affected about 38% of the abutment in the present study, whereas a mean prevalence of 4% was reported by others<sup>[3]</sup>. This high prevalence of periodontal disease measurements could be due to lack of professional maintenance therapy

where oral hygiene measures are regularly reinforced. Prevalence of this complication steadily increased with increasing time since placement.

Loss of retention was observed in about 16% of the prostheses in the present study, whereas in a previous meta analysis it ranged from 0-13%<sup>[3]</sup>. The increased length of service duration, in the present study, was found to be the increased number of loose units which is similar to results of other studies<sup>[7]</sup>. The prevalence of endodontic complication was recorded in nearly 11% of the abutments which is similar to that reported earlier<sup>[3]</sup>. In the present study, no incidence of abutment fracture was observed, whereas in other studies it ranged from 0.7-25%<sup>[3]</sup>. In the current study, a high prevalence of prostheses with open margins was also found which could be a contributor or a consequence of the high caries prevalence. Prevalence of caries was almost 10 times higher for prostheses with than those without open margins. These findings are similar to a finding of an earlier study<sup>[15]</sup>. Although not all patients with poorly fitting prostheses develop caries, this is not an excuse for providing patients with such restorations.

A possible explanation for the high prevalence of complications in the present study could be related to the nature of the selected sample, lack of initial data and recall visits. Dental school patients (mostly non Saudi) may be different from the general Saudi population. For example, income and education level tend to be lower among these non Saudi patients. An increased prevalence of caries and periodontal disease in the present sample suggests a lower dental awareness. Another reason for the high complications rate could be attributed to the lower quality of the delivered prostheses as for example; more than 60% of prostheses had unsatisfactory esthetics. None of these patients rejected their prostheses at the time of insertion due to lack of dental awareness and education level in general. Most of the non Saudi populations included in this study are either drivers, street workers or their dependent. Developing effective strategy to improve success and survival of fixed prostheses in Saudi Arabia for this particular population is certainly needed.

Formulating effective methods to increase dental awareness and subsequently prevent or at least reduce prevalence of dental diseases are required. Furthermore, dental practitioners must constantly upgrade their clinical skills, their knowledge of biomaterial and understanding of laboratory techniques. Recording the gingival and prostheses conditions



at the time of insertion is crucial. Future studies are needed with initial data recorded at the prostheses insertion, control group, regular recall visits for the patient and unified laboratory eminence. Double blind control clinical trial is also needed as this particular study is prospective in nature.

### Conclusion

With the evaluation analysis in this study, it can be concluded that the prevalence of complications associated with fixed prostheses was high among the present study sample. There is a vast need to improve the success and the survival of fixed prostheses by formulating effective methods to control dental diseases and to increase dental awareness. Furthermore, dental practitioners require constant upgrading in their clinical skills, their knowledge of biomaterial and the understanding of laboratory techniques.

### References

- [1] **Tan K, Pjetursson BE, Lang NP, Chan ES.** A systematic review of the survival and complication rates of fixed partial dentures (FPDs) after an observation period of at least 5 years. *Clin Oral Implants Res* 2004; **15**(6): 654-666.
- [2] **Creugers NH, Kreulen CM.** Systematic review of 10 years of systematic reviews in prosthodontics. *Int J Prosthodont* 2003; **16**(2): 123-127.
- [3] **Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY.** Clinical complications in fixed prosthodontics. *J Prosthet Dent* 2003; **90**(1): 31-41.
- [4] **Sailer I, Pjetursson BE, Zwahlen M, Hämmerle CH.** A systematic review of the survival and complication rates of all-ceramic and metal-ceramic reconstructions after an observation period of at least 3 years. Part II: Fixed dental prostheses. *Clin Oral Implants Res* 2007; **18**(Suppl 3): 86-96.
- [5] **Pjetursson BE, Sailer I, Zwahlen M, Hämmerle CH.** A systematic review of the survival and complication rates of all-ceramic and metal-ceramic reconstructions after an observation period of at least 3 years. Part I: Single crowns. *Clin Oral Implants Res* 2007; **18**(Suppl 3): 73-85.
- [6] **Creugers NH, Käyser AF, van 't Hof MA.** A meta-analysis of durability data on conventional fixed bridges. *Community Dent Oral Epidemiol* 1994; **22**(6): 448-452.
- [7] **Scurria MS, Bader JD, Shugars DA.** Meta-analysis of fixed partial denture survival: prostheses and abutments. *J Prosthet Dent* 1998; **79**(4): 459-464.
- [8] **De Backer H, Van Maele G, De Moor N, Van den Berghe L.** An up to 20-year retrospective study of 4-unit fixed dental prostheses for the replacement of 2 missing adjacent teeth. *Int J Prosthodont* 2008; **21**(3): 259-266.
- [9] **De Backer H, Van Maele G, De Moor N, Van den Berghe L.** Long-term results of short-span versus long-span fixed dental prostheses: an up to 20-year retrospective study. *Int J Prosthodont* 2008; **21**(1): 75-85.

- [10] **De Backer H, Van Maele G, Decock V, Van den Berghe L.** Long-term survival of complete crowns, fixed dental prostheses, and cantilever fixed dental prostheses with posts and cores on root canal-treated teeth. *Int J Prosthodont* 2007; **20**(3): 229-234.
- [11] **De Backer H, Van Maele G, De Moor N, Van den Berghe L, De Boever J.** A 20-year retrospective survival study of fixed partial dentures. *Int J Prosthodont* 2006; **19**(2): 143-153.
- [12] **Reuter JE, Brose MO.** Failures in full crown retained dental bridges. *Br Dent J* 1984; **157**(2): 61-63.
- [13] **Valderhaug J.** A 15-year clinical evaluation of fixed prosthodontics. *Acta Odontol Scand* 1991; **49**(1): 35-40.
- [14] **Leempoel PJ, Kayser AF, Van Rossum GM, De Haan AF.** The survival rate of bridges. A study of 1674 bridges in 40 Dutch general practices. *J Oral Rehabil* 1995; **22**(5): 327-330.
- [15] **Karlsson S.** A clinical evaluation of fixed bridges, 10 years following insertion. *J Oral Rehabil* 1986; **13**(5): 423-432.
- [16] **Ericson G, Nilson H, Bergman B.** Cross-sectional study of patients fitted with fixed partial dentures with special reference to the caries situation. *Scand J Dent Res* 1990; **98**(1): 8-16.
- [17] **Cheung GS, Dimmer A, Mellor R, Gale M.** A clinical evaluation of conventional bridgework. *J Oral Rehabil* 1990; **17**(2): 131-136.
- [18] **Palmqvist S, Swartz B.** Artificial crowns and fixed partial dentures 18 to 23 years after placement. *Int J Prosthodont* 1993; **6**(3): 279-285.
- [19] **Karlsson S.** Failures and length of service in fixed prosthodontics after long term function. A longitudinal clinical study. *Swed Dent J* 1989; **13**(5): 185-192.
- [20] **Babbush CA, Greene AH.** Implant dentistry: a long-term survey and comparative study with fixed bridgework. *J Oral Implantol* 1977; **7**(1): 89-105.
- [21] **Glantz PO, Ryge G, Jendresen MD, Nilner K.** Quality of extensive fixed prosthodontics after five years. *J Prosthet Dent* 1984; **52**(4): 475-479.
- [22] **Glantz PO, Nilner K, Jendresen MD, Sundberg H.** Quality of fixed prosthodontics after 15 years. *Acta Odontol Scand* 1993; **51**(4): 247-252.
- [23] **Laurell L, Lundgren D, Falk H, Hugoson A.** Long-term prognosis of extensive polyunit cantilevered fixed partial dentures. *J Prosthet Dent* 1991; **66**(4): 545-552.
- [24] **Leempoel PJ, Eschen S, De Haan AF, van 't Hof MA.** An evaluation of crowns and bridges in a general dental practice. *J Oral Rehabil* 1985; **12**(6): 515-528.
- [25] **Lundgren D, Nyman S, Heijl L, Carlsson GE.** Functional analysis of fixed bridges on abutment teeth with reduced periodontal support. *J Oral Rehabil* 1975; **2**(2): 105-116.
- [26] **Odman PA, Karlsson S.** Follow-up study of patients with bridge constructions performed by private dental surgeons and at a university clinic, 8 years following insertion. *J Oral Rehabil* 1988; **15**(1): 55-63.
- [27] **Glantz PO, Nilner K.** Patient age and long term survival of fixed prosthodontics. *Gerodontology* 1993; **10**(1): 33-39.

## المشاكل المتعلقة بالتركيبات الثابتة لاستعاضة الأسنان في كلية طب الأسنان بمدينة جدة بالمملكة العربية السعودية

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المستخلص. تمت دراسة ٧٥ مريض بمستشفى جامعة الملك عبدالعزيز بجدة المملكة العربية السعودية جاءوا لعلاج أمراض الفم واللثة. استوجبت هذه الدراسة الفحص الإكلينيكي والإشعاعي. كانت الخلاصة أن ٤٧,٤٪ من المرضى ذكور، ومتوسط أعمار المرضى ٦,٤٥. كانت هناك مشاكل أكثر شيوعاً في التركيبات الثابتة، كعدم مطابقة الألوان ٦٤٪، وكبر حجمها ٥٩,٩٪، وجود فجوات بينها وبين الأسنان ٤٩,٨٪، ووجود التسوس في الأسنان الحاملة لهذه التركيبات الثابتة ٤٠,١٪. كما كانت هناك علاقة طردية بين المشاكل المكتشفة، والمدة الزمنية للتركيبات الثابتة، وعدد الأسنان المستعاضة بها. هذا البحث اقترح أسلوباً علمياً لخفض نسبة حدوث المشاكل المتعلقة بالتركيبات الثابتة لاستعاضة الأسنان .