Evaluation of the most common failures and complaints of patients treated with fixed partial denture prostheses in a university clinic in Qassim, Saudi Arabia

Wael Faisal Alharbi1*, Pramod Punchiri Sadan2, Hasan Hamad Alamar3

ABSTRACT

Background: Fixed partial denture prosthesis is one of the most common and accepted treatment modalities for edentulous spaces in the dental arch. The current study aimed to evaluate the most common complaints of patients and the related failures associated with fixed partial denture prostheses treatment given by undergraduate students. The evaluation was carried out through the follow-up visits of the patients.

Methods: The study was conducted among Saudi adult males who received fixed partial dentures treatment by undergraduate students at the male campus, College of Dentistry, Qassim University, Saudi Arabia. A total of 75 abutment teeth were selected to evaluate the fixed partial denture prostheses, which included metal, porcelain fused to metal (PFM), all-ceramic crowns, bridges, and veneers.

Results: Fixed partial denture prosthesis treated in dental clinics included all-ceramic crowns (20, 27%), veneers (24, 32.4%), PFM crowns (16, 21.06%), PFM bridges (seven, 9.5%), on lays (one, 1.4%), and full metal crowns (six, 8.1%). Regarding contact with the adjacent tooth, it was found that 69 (93.2%) abutments had normal contacts, four (5.4%) abutments had open contacts, and only one (1.4%) contact was tight. Regarding occlusion and interferences, 71 (95.9%) showed good occlusal contact with no high points or interferences, whereas two (2.7%) had high points, and only one (1.4%) was out of occlusion. On examination of finish lines, 34 (45.9%) had equigingival finish lines, 30 (40.5%) had subgingival finish lines, seven (9.5%) had supragingival finish lines, and three (4.1%) were overhang.

Conclusion: This research came up with the factors that directly impacted the success of a fixed prosthesis. These factors included good preparation, qualified lab technician, and good oral hygiene habits for the patients. Moreover, any defect in these factors would lead to prosthesis failure.

Keywords: Fixed partial denture, fixed prosthesis, abutment.

Introduction

Fixed partial denture prosthesis is one of the most common and accepted treatment modalities for edentulous spaces in the dental arch [1]. Dental diseases adversely affect patient satisfaction regarding function, esthetics, performance, and alter their self-image [2,3]. Patient acceptability is very high toward fixed partial denture because it is a fixed option and gives a very natural and esthetic appearance [4].

The success of fixed partial denture prostheses depends on several factors, including adherence to sterilization protocols, proper patient selection, ideal abutment selection, good mouth preparations, accurate impressions, and excellent communication with the lab through well-documented work authorization forms [5]. The causes of failures in fixed partial denture can be attributed to numerous factors, including the stage at which it occurs, like before preparation, during preparation, during fabrication, during cementation, or after cementation. Failures can also be classified based...
on the mechanism of failures, such as biological failure, mechanical failure, esthetic failure, and maintenance failure. Fixed partial denture failure can also be in the form of patient complaints, either immediate or delayed [6]. Biological failures can be due to caries, pulpal injuries, pain, or sensitivity associated with these factors, periodontal breakdown, occlusal problems, tooth perforations, and tooth fractures [5]. Caries can develop due to an open or short margin, overextended margin, incomplete removal of caries, and poor oral hygiene [5]. Pain, sensitivity, and discomfort can be due to caries and pulpal injury, traumatic occlusion, excessive torque on abutments, excessive pressure on soft tissues, food retention on the occlusal surface, and cervical hypersensitivity of the abutment. Periodontal breakdown leads to the mobility of abutment, periodontal pocket formation, periodontal abscess, bad odor, and taste. This may be due to over or under contoured axial walls, poor marginal adaptation, periodontically affected abutment, inadequate abutment teeth in long-span bridges, and pontics with large contact area on the edentulous ridges [6]. Occlusal problems arise due to premature contact in centric and eccentric occlusion, leading to excessive tooth mobility. Tooth perforations can be due to faulty preparation, and tooth fractures can be coronal tooth fracture due to over reduction or recurrent caries, and root fractures due to trauma, caries extending to root surface, and excessive widening of root canal during endodontic treatment [7-9]. Mechanical failures can be due to cementation failure, retention failure, or occlusal problems. It can also be due to retainer, pontic, or connector failure and perforations because of occlusal wear. Esthetic failures occur mainly because of improper shade matching, inadequate tooth reduction, and improper masking of metal by esthetic material [10,11]. Maintenance failure occurs mainly due to poor oral hygiene and maintenance. Patient education about the importance of these factors and his responsibility in the success or failure of the restoration should be emphasized. The patient should be recalled for periodic clinical and radiographic examination to detect any harmful changes [5,12,13]. In the current study, patients who were treated with fixed partial dentures (FPD) were recalled for follow-up evaluation for 1 year. Patient complaints were recorded, and clinical evaluation and radiographic examination were carried out for necessary cases.

Subjects and Methods

The present study was carried out in the Dental Clinics, College of Dentistry, Qassim University (QU), Buraidah, Saudi Arabia. The study was conducted to evaluate the most common complaints of patients and related failures associated with fixed partial denture prostheses treatment given in the clinics by undergraduate students during the short-term follow-up period.

The study was conducted among Saudi adult males who received FPD by undergraduate students at the male campus, College of Dentistry, QU, Saudi Arabia.

The study included systemically healthy adult males and adult male patients who had their FPDs fabricated in the College of Dentistry, QU, by the undergraduate students in the past year and were called for follow-up appointments. Patients who had their FPDs fabricated before the stipulated time period were excluded.

To evaluate fixed partial denture prostheses, 75 abutment teeth were selected, including metal, porcelain fused to metal (PFM), and all-ceramic crowns, bridges, and veneers. The study subjects were examined, and the abutments were evaluated based on the following variables: open contact/tight contact, overhang, occlusal interferences, finish line and margins, periodontal health, plaque accumulation, and pain.

Regarding the evaluation of complaints and failures, open contacts/tight contacts were assessed clinically using dental floss to check for the contact with adjacent teeth. Overhanging was assessed clinically by using a dental explorer or radiographic examination. Occlusal interferences were evaluated clinically in centric relation by using articulating paper. Finish lines and margins were assessed clinically by tactile examination using a sharp dental explorer. Periodontal health and plaque accumulation were evaluated by measuring the probing depths and clinical attachments on six sites per tooth. Pain was assessed by examining recurrent marginal decay or caries using a dental explorer or radiographic examination for radiolucent areas.

Statistical analysis was carried out using Statistical Package for the Social Science (version 16). The descriptive statistics, as well as mean and standard deviations, were calculated for different variables. Pearson’s chi-square test was carried out to examine the prevalence of different complications.

Results

Fixed partial denture prosthesis treated in dental clinics included 20 all-ceramic crowns (27%), 24 veneers (32.4%), 16 PFM crowns (21.06%), seven PFM bridges (9.5%), one on lay (1.4%), and six full metal crowns (8.1%). Regarding contact with the adjacent tooth, it was found that 69 (93.2%) abutments had normal contacts, four (5.4%) had open contacts, and only one (1.4%) had tight contact. On examination for occlusion and interferences, 71 (95.9%) showed good occlusal contact with no high points or interferences, whereas two (2.7%) had high points, and only one (1.4%) was out of occlusion. On examination of finish lines, 34 (45.9%) had equigingival finish lines, 30 (40.5%) had subgingival finish lines, seven (9.5%) had supragingival finish lines, and three (4.1%) were overhung.

As far as patients’ complaints were concerned, 63 (85.1%) had no complaints and 11 (14.9%) had different complaints. None of them had complaints of pain. The
Method of cleaning employed by the patients included brushing (5.6.8%), brushing with flossing (21.28.4%), Miswak (16.21.6%), and brushing irregularly (16.21.6%), whereas 16 patients reported no brushing (21.6%). Among the participants, 36 (48.6%) had plaque accumulation and the periodontal health of 38 patients (51.4%) was poor.

The need for replacement of prosthesis was seen in 24.3% (18) of the cases, as shown in Table 4.

Discussion

Different clinical complications and failures are associated with fixed partial denture prosthodontics. These complications can be classified according to the level of prosthesis failure into varied categories. Goodacre et al. [8] reported that the greatest complications occurred by (27%), followed by resin-bonded prostheses (26%). After that, single crowns, and posts and cores (11% and 10%, respectively) had complication incidences. On the other hand, the lowest prevalence of complications was observed in all-ceramic crowns (8%). Caries was considered the most reported complications related to conventional FPD, and prostheses and abutments (18% and 8%, respectively). Regarding resin-bonded prostheses, de-bonding, tooth discoloration, caries, and porcelain fracture of prostheses (21%, 18%, 7%, and 3%, respectively) were the most reported complications. Additionally, conventional single crowns are correlated with some complications, such as endodontic treatment, porcelain fracture, retention loss, periodontal disease, and caries (3%, 3%, 2%, 0.6%, and 0.4%, respectively). Post-

**Table 1. Variables related to prosthesis and its design.**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variable</th>
<th>Responses - frequency expressed in number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type of prosthesis</td>
<td>Bridge (9.5) 20 (27) Veneer (32.4) PFM (21.6) Onlay (1.4) Full Metal (6.1)</td>
</tr>
<tr>
<td>2</td>
<td>Type of contact</td>
<td>No (93.2) 4 (5.4) High (1.4)</td>
</tr>
<tr>
<td>3</td>
<td>Occlusion</td>
<td>No High Point 71 (95.9) Out of Occlusion 1 (1.4) High Point 2 (2.7)</td>
</tr>
<tr>
<td>4</td>
<td>Finish line</td>
<td>Equal (45.9) Sub Gingival (40.5) Supra Gingival (9.5) Overhanging (4.1)</td>
</tr>
</tbody>
</table>

**Table 2. Type of responses related to patients’ complaints.**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variable</th>
<th>Responses - frequency expressed in number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patient complaint</td>
<td>No (85.1) Yes (14.9)</td>
</tr>
<tr>
<td>2</td>
<td>Pain</td>
<td>No (100) Yes (0)</td>
</tr>
</tbody>
</table>

**Table 3. Description of oral hygiene standards and complaints reported on follow-up.**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variable</th>
<th>Responses - frequency expressed in number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Method of cleaning</td>
<td>Brush (6.8) Brush with floss (28.4) Miswak (21.6) Sometimes (21.6) None (21.6)</td>
</tr>
<tr>
<td>2</td>
<td>Plaque accumulation</td>
<td>No (51.4) Yes (48.6)</td>
</tr>
<tr>
<td>3</td>
<td>Periodontal health</td>
<td>No (51.4) Yes (48.6)</td>
</tr>
</tbody>
</table>

**Table 4. Description of the need for retreatment.**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variable</th>
<th>Responses - frequency expressed in number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Replacement of prosthesis</td>
<td>No need (75.7%) Yes, needed (24.3%)</td>
</tr>
</tbody>
</table>
loosening, root fracture, caries, and periodontal disease were the complications associated with post and core (3%, 2%, and 3%, respectively). Finally, the most common complications related to ceramic crowns included crown fracture, retention loss, endodontic treatment, and caries (7%, 2%, 1%, and 0.8%, respectively).

Padbury et al. [14] reported that periodontal tissue health is dependent on adequately designed restorative materials. Regarding restorative margins, even minimal encroachment on the subgingival tissue might cause harmful effects on the periodontium. Furthermore, a more plaque-induced inflammatory response may occur if deep margin placement risks invade gingival soft tissues to the tooth. Orthodontic extrusion or crown-lengthening surgery should be provided during the placement of restorative margins near the alveolar crest for providing proper tooth structure. It was reported that at least 3 mm space should be provided from the restorative margin to the alveolar bone, including a biologic width space of 2 mm and a

Moimaz et al. [15] reported an association between partial denture prosthesis and periodontal diseases. Most cases might be prevented by implementing plaque control interventions. More plaque control programs are required to decrease the development of periodontal disease among the general population.

Ortolan et al. [16] reported that adequate motivational and educational measures could improve oral hygiene even after FPD placement. Additionally, better oral hygiene levels were reported among patients with single crowns than patients with FPDs or crown plus FPDs. On the contrary, oral hygiene status did not differ among patients with fixed appliances resulted from different materials. Also, better oral hygiene was observed among young patients compared to elderly patients. At the same time, patients with fixed appliances in both jaws showed the worst hygiene levels. Fixed prosthodontic work should be checked regularly to achieve a longer life span.

Al-Sinaid et al. [5] compared the abutment teeth with the non-abutment one and reported that the abutment teeth were more prone to periodontal pocket development, gingival inflammation, and plaque accumulation. Additionally, the periodontal condition of abutment teeth is affected by both FPD insertion duration and the patient’s age. A higher score of gingival indices, plaque, and a prober pocket depth was found in the abutment teeth with subgingival crown margins compared to abutments with supragingival crown margins. Dhima et al. [6] reported that the survival rates of single ceramic crowns were 95.1% for 5 years, which decreased to 92.8% at 10 years. In the FPD prosthesis (abutments), 20 had all-ceramic crowns, 24 had veneers, 16 PFM crowns, 7 PFM bridges, one onlay, and six had full metal crowns. Normal healthy interdental papilla was allowed through a properly located contact area, filling the interproximal space. Besides, it prevents impingement to the gingival tissues’ im-pigmentation through preventing food from packing between the teeth. Approximately 93.2% of the abutments had normal contacts, 5.4% had open contacts, and only 1.4% had a tight contact [17].

Premature contacts on the centric and eccentric occlusal surface might result in interferences and excessive tooth mobility that are considered FPDs biological failure. Regarding occlusion for interferences, the majority (95.9%) showed a good occlusal contact with no interference, 2.7% had high points, and 1.4% was out of occlusion. In case of non-esthetic areas, margins’ placement can be supragingival, which has the lowest impact on the periodontium margins. Regarding the examination of finish lines, 45.9% had equigingival finish lines, 40.5% had subgingival finish lines, 9.5% had supragingival finish lines, and 4.1% was overhang [18,19].

A successful prosthesis depends on a healthy periodontal environment, and periodontal health depends on the continued integrity of the prosthodontic restoration. Gingival inflammation and plaque accumulation could be occurred by over-contoured restoration. These inflammation sets might cause bone resorption if restoration’s margin intrudes into the biologic width. Brushing, brushing with flossing, Miswak, and brushing irregularly (6.8%, 28.4%, 21.6%, and 21.6%, respectively) are the most common cleaning methods employed by the patients. Plaque accumulation and poor periodontal health was seen among 48.6% and 51.4% of the participants, respectively. In addition, 24.3% of the patients reported a need for prosthesis replacement.

**Conclusion**

The current study reported that among the participants, 93.2% had normal contacts with abutments, 5.4% had open contacts, and 1.4% had tight contact. In terms of occlusal interferences, 95.9% had no occlusal interferences with no high points, 2.7% had high points, and 1.4% were out of occlusal contacts. Hence, it can be concluded that among the participants, the failure rate of prostheses was comparatively minimal. Additionally, 45.9% had equigingival finish lines, 40.5% had subgingival finish lines, and only 9.5% had the ideal supragingival finish line. Plaque accumulation was seen in 48.6%, poor periodontal health was reported among 51.4%, and the need for replacement of prosthesis was observed among 24.3%, which can be considered a significant value.

**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPD</td>
<td>Fixed Partial Dentures</td>
</tr>
<tr>
<td>PFM</td>
<td>Porcelain Fused to Metal</td>
</tr>
</tbody>
</table>

**Conflict of interest**

The authors declare that there is no conflict of interest regarding the publication of this article.

**Funding**

None.

**Consent to participate**

Informed consent was obtained from all the participants.
Evaluation of the most common failures and complaints of patients treated with FPDs

Ethical approval
Ethical approval was granted by Ethics Committee, Kingdom of Saudi Arabia Ministry of Higher Education, Qassim University, College of Dentistry. via reference: EA/500/2017, dated: 11-10-2017.

Author details
Wael Faisal Alharbi1, Pramod Punchiri Sadan2, Hasan Hamad Alamar3
1. Dental Surgeon, Qassim University, Buraydah, Kingdom of Saudi Arabia
2. Associate Professor, Department Of Prosthetic Dental Sciences, Qassim University, Kingdom of Saudi Arabia
3. King Saud Hospital, Qassim, Kingdom of Saudi Arabia

References