EVALUATION OF USPHS CRITERIA FOR MARGINAL ADAPTATION IN FIXED DENTAL PROSTHESIS- A RETROSPECTIVE STUDY

Aman Merchant, Subhabrata Maiti*, Dr. Ashok V
1Saveetha dental college and hospital Saveetha institute of medical and technical science, Saveetha university Chennai, India
2Senior Lecturer Department of Prosthodontics Saveetha dental college and hospital Saveetha institute of medical and technical science, Saveetha university Chennai, India
3Professor and Head, Department of Prosthodontics, Saveetha dental college and hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077,TamilNadu ,India.

Abstract

Aim: This study aims to evaluate the prevalence of the scores of USPHS guidelines for marginal adaptation and check its association with the qualification of the dental students.

Materials and Methods: This retrospective study was carried out from the data obtained from the patients’ case sheet. A total of 730 subjects were selected, undergoing treatment for fixed dental prosthesis. The prevalence of three different scores was checked. Group 1- Score of 0, Group 2- Score of 1, Group 3-Score of 2. The frequency of each score was checked and a Chi square test was done to evaluate the correlation between the scores and qualification of the dental student.

Results: It was observed that maximum students achieved a score of 0, followed by a score of 1 and very few people achieved a score of 2. Within the groups, it was seen that the prevalence of the score 0 was seen more in undergraduate students as compared to the post graduate students.

Conclusion: It can be concluded that the overall results achieved by the students were good. Further studies need to be done to verify the results.

Clinical Significance: Marginal fit of the prosthesis is one of the major factors influencing the strength and longevity of the prosthesis. Marginal discrepancies can lead to a lot of endodontic and periodontal problems. Hence, the clinician should try and achieve a good marginal adaptation.

Keywords: Accuracy; Discrepancy; Marginal fit; USPHS criteria.

DOI: 10.47750/pnr.2022.13.S04.149

INTRODUCTION

A dental practitioner mainly aims to restore the form, function and esthetics of the tooth without jeopardizing the remaining soft and hard tissues(Rosenstiel, Land and Fujimoto, 2006; Ariga et al., 2018). A successful fixed dental prosthesis is largely dependent upon the adequate fit of the prosthesis(Basha, Ganapathy and Venugopalan, 2018; Duraisamy et al., 2019). Marginal integrity and adaptation have been reported to be the most important factors affecting restoration longevity(Conrad, Seong and Pesun, 2007; Peumans et al., 2013). The prosthesis should have a good marginal fit(Ganapathy et al., 2016; Ganapathy, Kannan and Venugopalan, 2017). An ill fitting restoration will not only damage the tooth structure, but also the surrounding periodontium(Jyothi et al., 2017). It provides a medium for the bacteria to adhere on, which can cause secondary caries and gingival inflammation(Bader et al., 1991; Knoornschild and Campbell, 2000; Subasree, Murthykumar and Dhanraj, 2016). The toxins released by the bacteria can percolate the dentinal tubules and cause endodontic problems(Felton et al., 1991; Goodacre et al., 2003; Selvan and Ganapathy, 2016; Vijayalakshmi and Ganapathy, 2016). Loss of marginal integrity can cause stress concentration that will reduce the strength and longevity of the prosthesis(Tuntiprawon and Wilson, 1995; Jain, Ranganathan and Ganapathy, 2017).

Since marginal adaptation plays such an important role, certain guidelines should be present to evaluate the marginal fit of the prosthesis(Ashok and Suvitha, 2016). One such important guideline is the USPHS guidelines to evaluate the marginal fit of the prosthesis.

The USPHS guidelines have certain scores according to the fit of the prosthesis. The scoring is as follows:

Alpha- Explorer does not catch
Beta- Explorer catches, no visible crevice is visible into which the explorer cannot penetrate.
Gamma- Obvious crevice at margins, enamel, dentine or base exposed.
Delta- Restoration mobile, fractured or missing

According to this score, clinical decisions can be taken regarding the prosthesis (Ashok et al., 2014; Venugopalan et al., 2014). Our team has extensive knowledge and research experience that has translated into high quality publications (Kumar et al., 2006; Devi and Gnanavel, 2014; Varghese et al., 2015; Sivamurthy and Sundari, 2016; Chen et al., 2019) (Rao and Kumar, no date; Nair, Jeevanandam and Vignesh, 2018; Anbu et al., 2019; Sekar et al., 2019; Johnson et al., 2020). Now the growing trend in this area motivated us to pursue this project. This study aims to evaluate the prevalence of different scores of USPHS guidelines for marginal adaptation and check its correlation with the qualification of the operator.

Materials and Methods

Study Design
This retrospective cross sectional study was carried out in the Department of Prosthodontics, Saveetha Dental College, Chennai, India. The present study was approved by the Ethics Committee of Saveetha Dental College, Chennai, India. The data was obtained from the case records of the patients coming to the outpatient department of the college.

Ethical approval number- SDC /SIHEC/2020/DIASDATA/0619-0320

Sample selection
From June 2019 to May 2020, the subject selection of this study was done in Saveetha Dental College, Chennai, India based on the inclusion and exclusion criteria.

Inclusion Criteria
1) At least 18 years old.
2) Healthy subjects with no history of systemic diseases.
3) Both genders.
4) Patients undergoing a fixed partial denture treatment.
5) Signed informed consent

Exclusion criteria
1) Patients with systemic disease
2) Alcoholic patients
3) Patients indicated for removable prosthesis
4) Patients indicated for implant placement
5) Patient not willing for the treatment.

After the inclusion and exclusion criteria, the number of subjects were shortlisted from 86000 to 730.

Groups
For convenience, the scoring was modified a little
Group 1: Score 0 (Smooth margins)
Group 2: Score 1 (All margins closed)
Group 3: Score 2 (Obvious crevice at the margins)

Statistical Analysis
All analyses were conducted using SPSS 21 (SPSS Inc., Chicago, IL). Descriptive statistics such as frequency was carried out for each model. A Chi square test was done to determine the correlation between the score of the guidelines and the qualification of the operator.

Statistical Variables
The independent variables in this study are the study groups.
The dependent variables in this study are the scores of the USPHS guidelines.

RESULTS
In this study, it is observed that maximum students achieved a score of 0 (62.5%), which indicated a smooth margin, followed by a score of 1 (34.1%), which indicated that all the margins are closed. Few students achieved a score of 2 (3.4%), which indicated obvious crevices at the margins (Table 1) (Figure 1).
It is also observed that the prevalence of score zero was maximum in undergraduate students (64.2%) as compared to postgraduate students (55.6%) (Table 2) (Figure 2).

DISCUSSION
A good marginal fit is mandatory to prevent the longevity of the restoration. Since, it is impossible to achieve a 100% fit every time, a certain amount of marginal discrepancy is acceptable. A fixed value for marginal discrepancy of fixed restoration is difficult to identify in the literature. American Dental Association (ADA) specification No. 8 has reported that the thickness of the luting cement used for cementation of a prosthesis should not be beyond 25μm for a Type I luting agent and 40μm for Type II luting agent. Christenson was in consensus with the ADA specification (Christensen, 1971). Fransson et al. (Fransson, Øilo and Gjeitanger, 1985) and Mc Lean and Fraunhofer et al. (McLean and Von, 1971) reported that the clinically acceptable marginal gap should be less than 150μm and 120μm respectively. Mc Lean reported in his study that marginal discrepancy of less than 120μm is clinically acceptable (McLean and Von, 1971). Additionally, McLean and von Fraunhofer examined the marginal fit of 1000 fixed restorations over a period of 5 years and deduced that a marginal gap less than 80 μm is difficult to detect under clinical conditions.

In this study, it is observed that the prevalence of score zero was maximum in undergraduate students (64.2%) as compared to postgraduate students (55.6%). These results are in contrast to the normal thought process that the postgraduate students will show better results than the undergraduates. Certain authors have reported in their articles that the undergraduate students have shown equally good results as the postgraduate students (Mattheos et al., 2009). One more possibility which cannot be neglected is that the postgraduate students analyse the results very critically, whereas the undergraduate students are not fully well versed analysing minor discrepancies. This can be the reason for the post graduate students having less prevalence of the score 0. The prevalence of the score 1 was seen more with the postgraduates (44.4%) than the undergraduates (31.6%). As mentioned earlier, due to critically analyzing the marginal fit, the prevalence of the score of 1 was higher than the undergraduates. The prevalence of the score of 2 was only seen in the undergraduate students (4.3%), however, it was only a handful of students. The correlation between the scores of USPHS criteria and qualification of the student showed both clinically and statistically significant differences.

Although, this study showed that the prevalence of score 0 was the most, it has certain limitations. Firstly, even after specific guidelines, scoring is subjective from individual to individual. There might be a difference in the thought process between the undergraduates and post graduates (Kannan and Venugopalan, 2018). Secondly, there is a chance of some minute errors clinically (Ajay et al., 2017). Our institution is passionate about high quality evidence based research and has excelled in various fields (Pc, Marimuthu and Devadoss, 2018; Ramesh et al., 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai et al., 2019; Sridharan et al., 2019; Vijayashree Priyadharshini, 2019; Mathew et al., 2020). We hope this study adds to this rich legacy. It should have been verified radiographically for proper validation. Thirdly, the kind of coping framework can create bias in the results. Hence, more studies need to be done under one operator with proper standardization protocols.

CONCLUSION
The present study concludes that most of the dental students had achieved a score of 0, which indicated very good results. The students should be motivated to improve their results. Seminars should be conducted for the students to teach them the importance of marginal accuracy and how to achieve it. More number of invivo studies needs to be done under one operator to avoid bias. Digital impressions can be taken to improve the marginal fit of the prosthesis. With the advancement in technology, it would be more prudent to use a micro CT or CBCT to evaluate the volumetric changes in the marginal gap.

CLINICAL SIGNIFICANCE
Marginal adaptation is one of the key factors determining the strength and longevity of the prosthesis. Inadequate marginal fit can be detrimental to the abutment tooth due to leaching of the luting agent, which can lead to endodontic and periodontal complications. Hence, it is of utmost importance, as clinicians to ensure accurate fit of the prosthesis.

ACKNOWLEDGEMENT
We would like to acknowledge Saveetha dental college and hospital for providing complete patient details required for the study purpose and their constant help and support for this research.
REFERENCES


Figure 1: Bar graph depicting the prevalence of USPHS scores for marginal adaptation. The X- axis represents the various scores for marginal fit according to the USPHS guidelines and Y- axis represents the percentage of cases. The most prevalent of the scores was score 0 (62.5%), followed by score 1 (34.1%) and the least prevalent score was score 2 (3.4%).
Figure 2: Bar graph representing the association between scores for marginal adaptation according to the USPHS guidelines and student qualification. X-axis represents the student qualification and Y-axis represents the percentage of patients having the scores with Score 0 (Blue), Score 1 (Green) and Score 2 (Red). There is a statistical significant association between marginal adaptation scores and student qualification [Chi square value- 13.132, p value- 0.001 [p<0.05]. Undergraduates gave a higher marginal adaptation score of 0 as compared to the postgraduates.

TABLES AND LEGENDS

Table 1: Table depicting the frequencies of the scores of marginal fit according to the USPHS guidelines. The most prevalent of the scores was score 0 (62.5%), followed by score 1 (34.1%) and the least prevalent score was score 2 (3.4%).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score 0</td>
<td>456</td>
<td>62.5%</td>
</tr>
<tr>
<td>Score 1</td>
<td>249</td>
<td>34.1%</td>
</tr>
<tr>
<td>Score 2</td>
<td>25</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Table 2: Table depicting the association of the USPHS guidelines for marginal fit score and student qualification. There is a statistical significant association between marginal adaptation scores and student qualification [Chi square value- 13.132, p value- 0.001 [p<0.05]. Undergraduates gave a higher marginal adaptation score of 0 as compared to the postgraduates, whereas, postgraduates gave a higher marginal adaptation score of 1 as compared to the undergraduates.

<table>
<thead>
<tr>
<th>Student Qualification</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Chi square value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>376</td>
<td>185</td>
<td>25</td>
<td>13.132</td>
<td>0.001</td>
</tr>
<tr>
<td>% within the group</td>
<td>(64.2%)</td>
<td>(31.6%)</td>
<td>(4.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post graduate</td>
<td>80</td>
<td>64</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within the group</td>
<td>(55.6%)</td>
<td>(44.4%)</td>
<td>(0.0%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>