

Retrospective Study

The Causes of Marginal Discrepancy of Fixed Dental Prostheses: A Cross-Sectional Study

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ABSTRACT

Objective

Periodontal destruction observed in restored teeth is strongly caused by marginal discrepancy of the restoration, which is closely influenced by the tooth preparation, the technique of retraction and impression.

Materials and Methods

A hundred practitioners were selected to constitute the study's sample. A self-administered questionnaire survey was carried out. The questionnaire was filled in the practitioner's office, completed in the absence of the investigator. However, it has been completed for some clarifications by an interview. A digital form made through the Google Forms application provided free by the Google search engine. The questionnaire included two sections: The identification of the practitioner: this is general information about the practitioner. The conduct of prosthetic treatment. The causes of marginal discrepancy: This section concerns the major factors responsible for a good marginal fit. The collected data was introduced and processed by the microcomputer using the statistical software XLSTAT 2015 for Windows. A simple statistical analysis made it possible to calculate the percentage of the different variables, from their frequency.

Results

There is a significant correlation between marginal discrepancy and the respect of the finish line geometry ($p=0.001$). The technique of retraction which provided the best marginal fit was the use of expasyl paste ($p=0.18$). There was a significant association between marginal discrepancy and the material of impression, marginal adaptation is found in 76% for impressions made by alginate, 45% for impressions made by silicone, and 100% for impressions made by polysulphides ($p=0.01$).

Conclusion

Within limitations of this study, it can be concluded that the respect of guidelines of preparation especially the finish line and the good choice of the retraction technique and the material of impression are the major keys to have a good marginal fit.

Keywords

Dental marginal adaptation; Dental impression materials; Tooth preparation; Gingival retraction techniques.

BACKGROUND

Good fitting crown is the most important technical factors for the long-term success of dental restorations.

Marginal discrepancy can lead to plaque and bacterial deposition, which can generate many complications as periodontal

damage, microleakage¹ and it may affect the retentive aspect of the restoration.

Several authors explained the marginal discrepancy by the lack of rigor in the completion of the clinical sequence (preparation design, technical and impression materials, decontamination of impressions and sealing) or the laboratory sequence (realization

of the working cast, preparation, and treatment of positive unit models).² This study aims to identify the factors that lead to good fitting crowns.

MATERIALS AND METHODS

This is a cross-sectional study. It lasted for a period of two months, from January 2017 to February 2017.

The example that was the subject of our study is made up of qualified dentists practicing in Tunisia in the private sector, without distinction of sex. It has been established according to the following selection criteria:

Criteria of Inclusion

- To be a dentist
- Be registered on the council of the order
- Practice in Tunisia
- Practice in the private sector

Criteria of Exclusion

- Students
- Non-registered practitioners on the council of the order
- Dentists who specialize in a specialty other than the fixed prosthodontics.

According to these criteria, 100 practitioners were selected to constitute the study's sample.

We carried out a self-administered questionnaire survey. The questionnaire was filled in the practitioner's office, completed in the absence of the investigator. However, it has been

completed for some clarifications by an interview. A digital form made through the Google Forms application provided free by the Google search engine.

The questionnaire included two sections:

- The identification of the practitioner: this is general information about the practitioner.
- The conduct of prosthetic treatment.
- The causes of marginal discrepancy: this section concerns the major factors responsible for a good marginal fit.

The collected data was entered and processed by the microcomputer using the statistical software XLSTAT 2015 for Windows. A simple statistical analysis made it possible to calculate the percentage of the different variables, from their frequency.

Note: No Institutional Review Board (IRB) or any other board's permissions were required for this study.

The Questionnaire

The purpose of this study is to identify the causes of marginal discrepancy and the major factors that allow dentists to perform prosthesis with a good marginal fit.

A dear colleague let us express our thanks in response to your cooperation on which the success of this work depends.

It is divided into 3 sections: 1. The general information's section that contains information about the practitioner; 2. The conduct of prosthetic treatment; 3. Major difficulties faced while fitting.

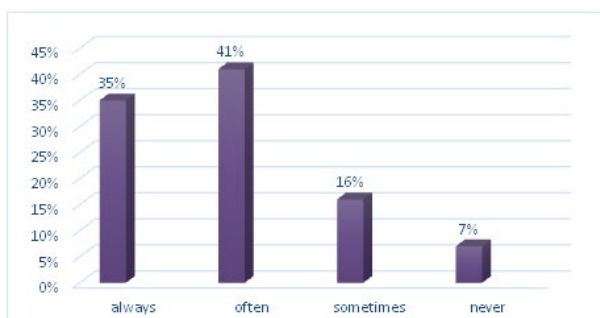
The questionnaire					
I-General information about the dentist					
1- Seniority of practice	< 5 years	<input type="checkbox"/>	Between 5 and 10 years	<input type="checkbox"/>	Between 10 and 20 years <input type="checkbox"/> More than 20 years <input type="checkbox"/>
2- Specialized in fixed prosthesis?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	
3- How do you judge the practice of the fixed prosthesis?	Easy	<input type="checkbox"/>	Affordable	<input type="checkbox"/>	Difficult <input type="checkbox"/>
4- On an average, how much fixed prosthesis do you realize per month			Between 1 and 5 prosthesis per month	<input type="checkbox"/>	Between 5 and 10 prosthesis per month <input type="checkbox"/> More than 10 prosthesis per month <input type="checkbox"/>
II-Conduct of prosthetic treatment					
1-What are the steps in the elaboration of the fixed prosthesis that you judge unnecessary?					
The treatment plan	<input type="checkbox"/>	The preliminary impression	<input type="checkbox"/>	The provisional restoration	<input type="checkbox"/>
The preparation	<input type="checkbox"/>	The global impression	<input type="checkbox"/>	Inter occlusal records	<input type="checkbox"/>
Trimming	<input type="checkbox"/>	Fitting	<input type="checkbox"/>	Cementation	<input type="checkbox"/>
A- the preparation					
Do you respect the choice of the type of the finishing line geometry according to the type of crown that the tooth will receive?	Always	<input type="checkbox"/>	Never	<input type="checkbox"/>	Sometimes <input type="checkbox"/> Often <input type="checkbox"/>

Do you entrust certain steps of the preparation to the laboratory technician?	Always	<input type="checkbox"/>	Never	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Often	<input type="checkbox"/>
If you do, please specify								
Do you do a temporary prosthesis?	Always	<input type="checkbox"/>	Never	<input type="checkbox"/>	Sometimes	<input type="checkbox"/>	Often	<input type="checkbox"/>
If not, why?								
B-the global impression								
What is the material you use to take the global impression?	Reversible hydrocolloid	<input type="checkbox"/>	Irreversible hydrocolloid	<input type="checkbox"/>	Silicone	<input type="checkbox"/>	Polysulfures	<input type="checkbox"/>
Others : Please specify								
Do you consider the type of periodontal tissue to choose the global impression technique?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>				
What are the gingival retraction techniques that you use?	Retraction cord Expasyl	<input type="checkbox"/>	Temporary prosthesis	<input type="checkbox"/>	Electro-surgery	<input type="checkbox"/>	Rotary curettage	<input type="checkbox"/>
Others : Please specify								
III- Difficulties faced while fitting								
In your practice, is marginal discrepancy one of the frequent problems you faced while fitting?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>				
If no, please specify the frequent problem you faced while fitting Cementation								

RESULTS

Our study showed that 35 practitioners always adapted the geometry of finish line to the crown's type, 41 dentists often respected finish line's geometry adapted to the type of restoration, 16 practitioners sometimes suited the geometry of finish line and seven dentists never did it (Figure 1).

Figure 1. The Respect of the Finish Line's Geometry Adapted to the Type of Restoration



Regarding the materials used for impression, 71 practitioners used silicones, 25 dentists preferred alginate, 2 others used polysulphides and no one used the reversible hydrocolloids (Figure 2).

For gingival retraction, 52 practitioners use the retraction cord, 18 favor the use of the temporary prosthesis, 17 dentists use rotary curettage, five practitioners use expasyl, four practitioners favor electro-surgery and four practitioners use other methods (Figure 3).

Figure 2. Materials Used for Impression

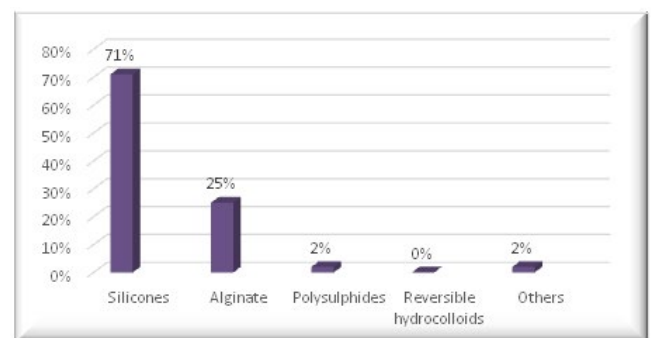
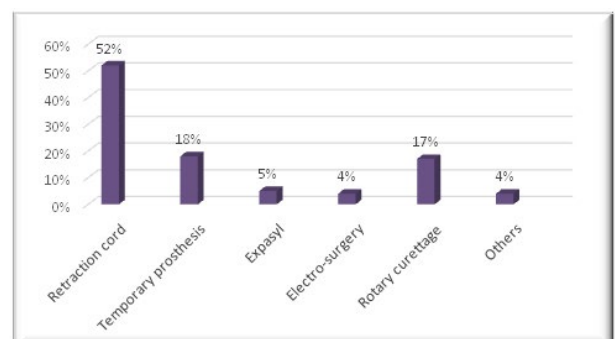


Figure 3. Techniques of Retraction



There was a significant association between marginal discrepancy and the respect the finish line geometry. Practitioners who always respect the profile of the finish line, have in 77 % a good marginal fit on their restoration ($p=0.001$) (Table 1).

Table 1. Relationship Between Marginal Discrepancy and the Respect the Finish Line Geometry

	Percent Good marginal fit	Percent Marginal discrepancy	Percent Total
Always	77(27)	23 (8)	100 (35)
Often	49(20)	51 (21)	100 (41)
Sometimes	19(3)	81 (13)	100 (16)
Never	50 (4)	50 (4)	100 (8)
Total	45 (54)	46 (46)	100 (100)
*Chi ² test: p=0.001; Fisher's exact test: p=0.001			

There was nosignificant correlation between marginal discrepancy and the technique of retraction according to the fisher's test ($p=0.19$). In fact, the best marginal adaptation was founded using expasyl (80%), second rotary curettage (71%), third, temporary prosthesis (67%), then the electro-surgery (50%) and finally the retraction cord with a success rate of 42% (Table 2).

Table 2. Relationship Between Marginal Discrepancy and the Retraction Technique

	Percent Good marginal fit	Percent Marginal discrepancy	Percent Total
Retractioncord	42 (22)	58 (30)	100 (52)
Temporaryprosthesis	67 (12)	33 (6)	100 (18)
Expasyl	80 (4)	20 (1)	100 (5)
Electro-surgery	50 (2)	50 (2)	100 (4)
Rotary curettage	71 (12)	29 (5)	100 (17)
Others	50 (2)	50 (2)	100 (4)
Total	54 (54)	46 (46)	100 (100)
*Chi ² test: p=0.19 Fisher's exact test: p=0.18			

There was a significant association between marginal discrepancy and the material of impression. In fact, marginal adaptation is found in 76% for impressions made by alginate, 45% for impressions made by silicone, 100% for impressions made by polyethers. ($p=0.01$) (Table 3).

Table 3. Relationship Between Marginal Discrepancy and the Material of Impression

	Percent Good marginal fit	Percent Marginal discrepancy	Percent Total
Silicones	45 (32)	55 (39)	100 (71)
Alginate	76 (19)	24 (6)	100 (25)
polyethers	100 (2)	0 (0)	100 (2)
Hydrocolloids reversible	0 (0)	0 (0)	0 (0)
Others	50 (1)	50 (1)	100 (2)
Total	54 (54)	46 (46)	100 (100)
*Chi ² test: p=0.031; Fisher's exact test: p=0.01			

DISCUSSION

The data obtained in this study showed that the respect of the fin-

ish line geometry had a significant effect on the marginal fit of the resulting restorations.

These results are consistent with those found by Ates and Yesil Duymus³ and with those founded by Bottino et al, which reported that the best cervical adaptation of metal crowns was achieved with the chamfer type of finish line.⁴

The study of Raul et al also showed that the marginal misfit measured in zirconium crowns with around shoulder finish line is significantly lower than the measured misfit in chamfer finish line restoration.

Our study reported that the best marginal adaptation was founded using expasyl. Comparing these results with those of the *in vitro* study of Wottsmann et al, we find almost the same results concerning the comparison between electro-surgery and the retraction cord where there is not a significant difference between these two methods.⁵

However, these results differ from those found in the comparative study of Shrivastava et al where he compared three gingival spacing methods, which are:

- Magic foam cord
- Expasyl paste
- Retraction cord impregnated with 15% aluminum chloride

Shrivastava et al reported that all the three displacement systems produced highly significant horizontal gingival displacement. Retraction cord soaked in 15% aluminum chloride produced maximum displacement (0.74 mm), followed by expasyl paste (0.48 mm) whereas magic foam cord produced the least displacement (0.41 mm).⁶

The results of our study also showed that the marginal adaptation is found in 76% for impressions made by alginate, 45% for impressions made by silicone, 100% for impressions made by polyethers.

These results are consistent with those found by Samet et al where they reported a positive correlation between the impression material and the reproduction of the finish line.⁷

However, the digital impression provided better marginal fit than the conventional impression.⁸

According to the study of Mello et al, the conventional method (321 μ m) showed greater marginal discrepancy when compared with the computer-aided design (CAD)/computer-aided manufacturing (CAM) system (89 μ m) ($p<.001$).⁹

The marginal adaptation of fixed dental prostheses is influenced not only by the manufacturing technique,¹⁰ but also by the restorative material.

In fact, the systematic review of Papadiochou and Pisiotis showed that most of the heat-pressed lithium disilicate

crowns had less marginal discrepancy (MD) values than those produced using a CAD-CAM system. Slip-casting crowns exhibited similar or better marginal accuracy than those fabricated with CAD-CAM. Compared with copy milling, the majority of zirconia restorations produced by CAD-CAM milling elicited better marginal adaptation.¹¹

CONCLUSION

Within the limitations of this study, it can be concluded that the respect of guidelines of preparation especially the finish line and the good choice of the retraction technique and the material of impression, are the major keys to have a good marginal fit.

CONFLICTS OF INTERESTS

The authors declare that they have no conflicts of interest.

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