

Clinical Evaluation of Fixed-Fixed Bridge Design and Cantilever Bridge Design in Diabetic Patient

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Abstract: Aims: To evaluate the effect of different types of fixed prosthesis in diabetic patient in term of success and failure. Purpose: To determine if the choice of the design of fixed prosthesis has an effect on the failure of FPD in the diabetic patient. Materials and methods: This is a retrospective study of 53 diabetic patients who visited the Diabetes and Endocrinology Hospital between January 2019 and May 2021. Patients underwent medical evaluation for their routine check-up were invited to take part in this study. Among the 53 patients, 6 patients were type I and 47 were type II. Results: The number of retainers, pontics, and the types of restoration were recorded, by examining 53 patients with 202 crown and bridge units from the Diabetes and Endocrinology Hospital/Tripoli. The collected data related to the bridge area were then subjected to descriptive analysis. The result of the study revealed that recession around the abutment was the most frequent complication in patients with Fixed-Fixed design (81.1%), while pain and pocket were the most frequent complications observed on patients with cantilever design (38.5%). Conclusion: Cantilever bridge design exhibit superior results than fixed-fixed design in diabetic patients. Choice of the appropriate design of fixed partial denture (FPD) can be effective in patients with diabetes. Clinical significance: By knowing the reason of failures, a proper treatment plan can be made so that the prosthesis will have a long time prognosis.

Keywords: Diabetes mellitus; Bridge Failure; Fixed Prosthodontic

1. Introduction

Diabetes Mellitus is a clinical syndrome specified by hyperglycemia due to absolute or relative deficiency of insulin. The two main types of Diabetes Mellitus include Type I or Insulin Dependent Diabetes Mellitus and Type II or Non-insulin dependent Diabetes Mellitus¹. Management of the diabetic dental patient must take into consideration the impacts of diabetes on dental treatment, as well as a clear appreciation for the co morbidities that accompany long standing diabetes mellitus². As the diabetes Mellitus is a nutritional metabolic disorder characterize by various oral and systemic problems. These patients when referred to dentist or prosthodontist for the provision of prosthetic treatment require multidisciplinary approach². In this study special focus is emphasized on the different important factors to be kept in mind when providing fixed prosthodontics treatment for such patients.

The use of crown and bridgework to restore a patient's dentition is a treatment performs by practitioners on a regular basis. Despite advances in the materials and technologies used to construct such restorations, and with the cement used to hold them, failure and the need to replace crowns and bridges occurs. Failure to achieve the desired specifications of design for function and esthetics would fail the prosthesis. Most of the time, the failures are conditions that occur during or after performed fixed prosthodontics treatment procedures³.

The reasons for failure may be divided into biological failures, mechanical failures, and esthetic failures. Mechanical failures are more directly under the influence of the clinician. Biological problems are less easily controlled and in some instances may be unrelated to the treatment or prosthesis.

More specifically, reasons of failure can be caries, uncemented restoration, over-contoured restoration, poor occlusal plane, periodontal disease, periapical involvement, failed post retained crowns, poor esthetics, crown perforation and defective margins of restorations^{3,4}.

The classification of failures was similar to those reported by Schwartz *et al.*⁵, and Walton *et al.*⁶ restoration that required repair or replacement was considered a failure. A failure due to periodontal disease would exhibit soft tissue pathosis, alveolar bone loss, cervical pocket formation, and excessive mobility.

Evaluation of the most appropriate bridge design for diabetic patients has not been studied yet, thus this research paper aimed to clinically evaluate the different type of fixed prosthesis in patient with Diabetes Mellitus.

2. Materials and Methods

The study was a retrospective examination study that conducted at the Diabetes and Endocrinology Hospital/Tripoli. Permission has been obtained from the committee in the Diabetes and Endocrinology Hospital prior to commencing the study. The classification of failures was similar to those reported by Schwartz *et al.* and Walton *et al.* to allow for comparison with previous studies. A restoration that required repair or replacement was considered a failure. A form was designed to record the data obtained from the patient. The prosthesis type, position, years of service, retainer/crown and pontic type were recorded.

The subjects in the study consisted of 53 controlled diabetic patients, 6 of the patients were type 1 and 47 type 2, 30 (57%) of the subjects were female and 23 (43%) were male,

ranging from 32-70 years old of age with male to female ratio 29.7: 70.3.

Patient recruitment: patients came to Diabetes and Endocrinology Hospital for routine medical evaluation for their routine check-up was invited to take part in this study (Figure 1). They were recruited in accordance with the study protocol. The subjects were requested to fill in the consent form and participate in the study.

A form was designed to record the data obtained from the clinical examination. The prosthesis type, position, years of service, retainer/crown and pontic type, and cause of failure, if any, were recorded. The clinical examination was conducted by one clinician standing in front of the subjects. Every subject was asked to sit in the dental chair in an upright position. Each case was examined carefully by use of sterile diagnostic instruments (oral mirror and round end probe) with the aid of chair light to evaluate all the prosthesis and surrounding area, then the data were recorded according to the previously prepared form.

3. Results

Data analysis

The data collected were entered to SPSS (statistical package for social science, Ink Illinois, USA) version 26

The length service of all restoration observed on this study was 60.4% less than 5 years as shown in (table 1).

Table 1: The length service of the prosthesis

The length service of all prosthesis		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 5 years	32	60.4	60.4	60.4
	more than 5 years	21	39.6	39.6	100
	Total	53	100	100	

Types of restoration were recorded Figure 1 illustrates the percent of the different type of prosthesis. Fixed-fixed bridge was found to be the most used type of prosthesis observed on 69.8% of all the patients participated in the study, and cantilever type was observed on 24.5% of the cases.

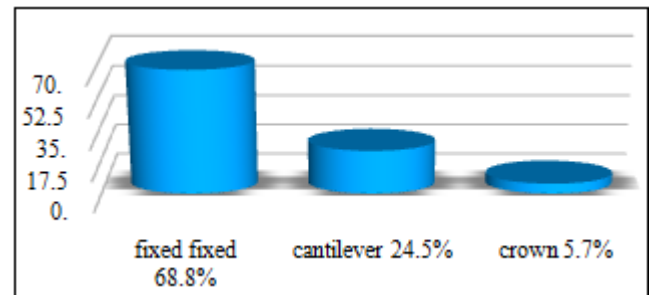


Figure 1: Type of Prosthesis

Looking at the results of fixed-fixed bridge, recession and pocket were found the most frequent complications with 81.1 and 75.7 respectively. pain was found in 64.9% of the patients and caries in 35.1%. The study also revealed that by examining the tissue around the abutment bleeding on probing was observed in 54.1% of the patients. Besides, swelling was observed in 40.5% with the abscess around the abutments in 37.8% with inflamed tissue around the abutment in 48.6% of the patients. Furthermore, the results revealed that retainer open margins were found in 29.7% and short margins in 13.5% Figure2 (Tables 2-10 respectively).

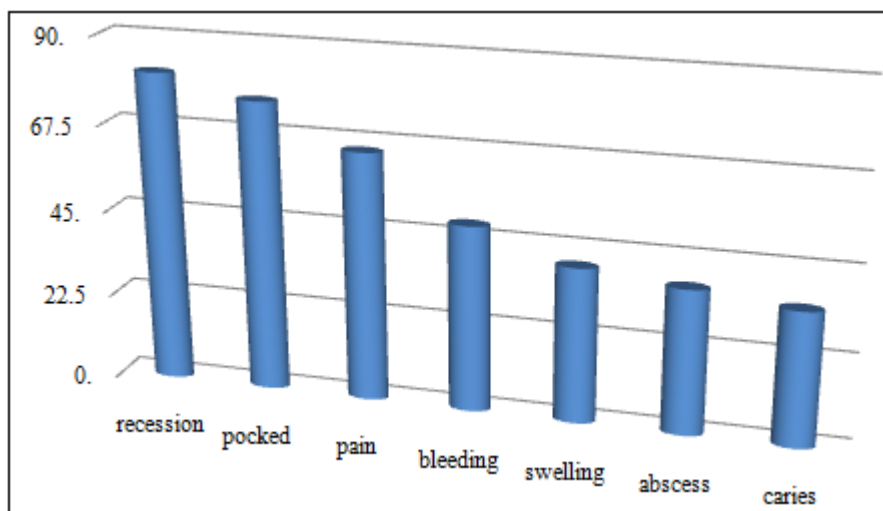


Figure 2: The common complication observed in abutment teeth

Table 2: Pain in Fixed-Fixed Bridge

pain in fixed-fixed		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	24	64.9	64.9	64.9
	No	13	35.1	35.1	100
	Total	37	100	100	

Table 3: Caries in fixed-fixed bridge

Abutment Caries		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	13	35.1	35.1	35.1
	No	24	64.9	64.9	100.0
	Total	37	100.0	100.0	

Table 4: Gingival bleeding in fixed-fixed bridge

Gingival bleeding	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	spontaneous	17	45.9	45.9
	on probing	20	54.1	100
	Total	37	100	100

Table 5: Swelling around abutment in fixed-fixed bridge

Swelling around Abutment	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	22	59.5	59.5
	Present	15	40.5	100.0
	Total	37	100.0	100.0

Table 6: Abscess around abutment in fixed-fixed bridge

Abscess around Abutment	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	23	62.2	62.2
	Present	14	37.8	100.0
	Total	37	100.0	100.0

Table 7: Pocket around abutment in fixed-fixed bridge

Abutment Pocket	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	9	24.3	24.3
	Present	28	75.7	100.0
	Total	37	100.0	100.0

Table 8: Recession around abutment in fixed-fixed bridge

Abutment Recession	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	7	18.9	18.9
	Present	30	81.1	100.0
	Total	37	100.0	100.0

Table 9: Tissue around abutment in fixed-fixed bridge

Tissue around abutment	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	19	51.4	51.4
	Inflamed	18	48.6	100.0
	Total	37	100.0	100.0

Table 10: Retainer margin in fixed-fixed bridge

retainer margin in f. f	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	21	56.8	56.8
	Open	11	29.7	86.5
	Short	5	13.5	100.0
	Total	37	100.0	100.0

In the clinical examination of patients with cantilever bridge the results showed that pain was found in 38.5% of the patients and caries in 23.1%. The study also revealed that by examining the tissue around the abutment bleeding on probing was observed in 69.2% of the patients. Besides, swelling was observed in 7.7% with the abscess around the abutments in 23.1%. The pocket was recorded in about 38.5% of the patients and the recession was found in 23.1% with inflamed tissue around the abutment in 42.3% of the patients. Furthermore, the results revealed that retainer open margins were found in 15.4% with no short margins detected (Tables 11-19 respectively).

Table 11: Pain in cantilever bridge

Pain in cantilever	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	38.5	38.5
	No	8	61.5	100.0
	Total	13	100.0	100.0

Table 12: Abutment Caries in cantilever

Caries in cantilever	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	23.1	23.1
	No	10	76.9	100.0
	Total	13	100.0	100.0

Table 13: Gingival Bleeding around abutment in cantilever bridge

Gingival bleeding	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	spontaneous	4	30.8	30.8
	on probing	9	69.2	100.0
	Total	13	100.0	100.0

Table 14: Swelling around abutment in cantilever bridge

Swelling Abutment Recession	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	12	92.3	92.3
	Present	1	7.7	100.0
	Total	13	100.0	100.0

Table 15: Abscess around abutment in cantilever bridge

Abutment Abscess	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	10	76.9	76.9
	Present	3	23.1	100.0
	Total	13	100.0	100.0

Table 16: Pocket around abutment in cantilever bridge

Abutment Pocket	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	8	61.5	61.5
	Present	5	38.5	100
	Total	13	100.0	100.0

Table 17: Recession around abutment in cantilever bridge

Abutment Recession	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NAD	10	76.9	76.9
	Present	3	23.1	100
	Total	13	100	100

Table 18: Tissue around abutment in cantilever bridge

gingival tissue around abutment	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	normal	10	76.9	76.9
	inflamed	3	23.1	100
	Total	13	100	100

Table 19: Retainer margin in cantilever bridge

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	normal	11	84.6	84.6
	open	2	15.4	100
	Total	13	100	100

Table 20 showed a comparison between the clinical observation found in fixed-fixed bridge design and cantilever bridge design. From the table it was obvious that cantilever bridge design presents best results than fixed-fixed design. The differences were remarkable specially in recession and pocket around the abutment.

Table 20: Comparison between fixed-fixed and cantilever bridge

Prosthesis Type	Fixed-Fixed bridge	Cantilever bridge
Abutment Pain	64, 9%	38, 5%
Abutment caries	35, 1%	23, 1%
Swelling around abutment	40, 5%	7, 7%
Abscess around abutment	37, 8%	23, 1%
Abutment pocket	75, 7%	38, 5%
Abutment recession	81, 1%	23, 1%
Inflamed tissue around abutment	48, 6%	23, 1%
Retainer margins		
open	29.70%	15.40%
short	23.50%	0%

4. Discussion

To the best of our knowledge, this study is the first assessing the effect of different types of fixed prosthesis on diabetic patients through a retrograde clinical evaluation, so it was difficult to make comparisons with previous studies reported in the literature.

The widespread of Diabetes Mellitus is growing, and its incidence and prevalence are expected to increase from 415 million in 2015 to 642 million in 2040⁷. The disease has two main types, in other word type 1 and type 2, with type 2 comprising the majority of the disease prevalence^{7, 8}. In 1999 American Academy of Periodontology issued a paper about diabetes and periodontal disease. They reported that especially in poorly controlled, the risk of periodontitis increases⁹. The results of current study showed that cantilever bridge design reveals good results than fixed-fixed design in term of bridge success. Recession and poket around the abutment teeth in patients with fixed-fixed design were very high, this may contributed to the oral manifestations that can be observed in diabetic patients such as periodontal diseases, dental caries, xerostomia, teeth loss, and delayed wound healing^{10, 11}

5. Conclusion

In conclusion recession and poker around the abutment teeth were found to be the most complications in diabetic patients with fixed-fixed bridge.

Cantilever bridge design exhibit superior results than fixed-fixed design in diabetic patients. Choice of the appropriate design of fixed partial denture (FPD) can be effective in patients with diabetes.

The purpose of any fixed prosthodontics treatment must be, to preserve the hard and soft tissues that are remaining rather than replacement of the lost part and these can be achieved if the prosthodontist knows the best treatment option for

diabetic patient so prognosis of the FPD will last for long time.

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