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Clinical Evaluation of Fixed Dental Prosthesis Failures in Indian Population: An In Vivo Study

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ABSTRACT

Aim: The purpose of this study was to evaluate the prevalence of causes of fixed dental prosthesis failures in Indian population.

Materials and method: A total of 158 patients were selected for the study who reported to the OPD of the Department of prosthodontics, Karnavati School of Dentistry, with complaints related to fixed dental prosthesis (FDP). Site and condition of the prosthesis and its abutments were evaluated and the cause of failure was classified accordingly by John J. Manappallil's classification.

Results: Majority of failures (32.27%) were found to be class III failure followed by class VI failure (24.05 %). 13.29 % failures were Class IV, 12.65 % failures were identified as class II, 12.02 % failures as class V and 5.69 % failures were categorized in class I failure.

Conclusion: Though earlier literature reported caries as the most common cause of fixed dental prosthesis failure, however present study reported class III failures, which include unserviceable restorations due to defective margins, technical failures or esthetic considerations as the most common cause. Therefore proper design of prosthesis is of utmost importance and should be kept in mind during fabrication of FDP.

Keywords: Abutments, Fixed partial denture, Prosthesis failure.

INTRODUCTION

"Technology in the hands of a skilled operator makes it possible to do more work of an even higher quality. But in the hands of one who has not mastered the skills of his or her profession, that technology merely enables one to do tremendous damage." - Herbert T. Shillingburg[1]

Fixed prosthodontic treatment involves the replacement and restoration of teeth by artificial substitutes that are not readily removable from the mouth. Its focus is to restore function, esthetics and comfort. To achieve predictable success in this technically exacting and demanding field, meticulous attention must be given to each and every detail: from the initial patient interview and diagnosis, through the active treatment phases and to a planned schedule of follow-up care. Otherwise, the result is likely to be unsatisfactory and frustrating for both dentist and the patient[2].

Most of the time, complications are conditions that occur during or after an appropriately performed fixed prosthodontic treatment procedures[3]. An objective evaluation of

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an existing restoration is necessary before arriving to a conclusion that it is defective and requires either replacement or repair. Some failures are the result of poor patient care while others occur as a result of defective design or inadequate execution of the clinical or laboratory procedures. The dental literature is replete with problems and failures related to traditional fixed prosthodontic treatment. These include clinical studies on long-term survival of FDP and reasons for loss of serviceability. In spite of the large number of studies, criteria for grading or classifying the type and severity of the failures are inadequate. The cause may be that signs and symptoms of failures are varied and often complex[4]. Knowledge regarding the clinical complications that can occur in fixed prosthodontics enhances the clinician's ability to complete a thorough diagnosis, develop the most appropriate treatment plan, communicate realistic expectations to patients and plan the time intervals needed for post-treatment care[3].

Table 1: John J. Manappallil's classification.

Class	Description
Class 1	Cause of failure is correctable without replacing restoration. (Figure1, Figure 2)
Class 2	Cause of failure is correctable without replacing restoration; however, supporting tooth structure or foundation requires repair or reconstruction. (Figure 3)
Class 3	Failure requiring restoration replacement only. Supporting tooth structure and/or foundation acceptable. (Figure 4 , Figure 5)
Class 4	Failure requiring restoration replacement in addition to repair or reconstruction of supporting tooth structure and/or foundation. (Figure 6, Figure 7)
Class 5	Severe failure with loss of supporting tooth or inability to reconstruct using original tooth support. Fixed prosthodontic replacement remains possible through use of other or additional support for redesigned restoration. (Figure 8, Figure 9, Figure 10)
Class 6	Severe failure with loss of supporting tooth or inability to reconstruct using original tooth support. Conventional fixed prosthodontic replacement is not possible. (Figure 11, Figure 12, Figure 13)

MATERIALS AND METHOD

A total of 158 patients were selected for the study who reported to the OPD of the Department of Prosthodontics with problems related to Fixed Dental Prosthesis (FDP). Among these patients, 65 (41%) were males and 93 (59%) were females ranging from 20 to 66 years of age. The number of retainers, pontic and type of restorations were recorded.

Type of pontic design and condition of abutment were evaluated after removal of FDP, material used for fixed dental prosthesis (cast metal, gold, acrylic, porcelain fused to metal, all ceramic) also were recorded. Site of the prosthesis and its condition was evaluated and the cause of failure was classified accordingly. Failures can be grouped into 6 categories according to classification of "John J. Manappallil"[4] with severity increasing from Class I to Class VI. (Table 1)

RESULTS

Majority of failures (32.27%) were found to be class III failures which include unserviceable restorations due to defective margins, technical failures, or esthetic considerations. 24.05 % failure were class VI that include failing long-span FPDs with supporting teeth that may be serviceable. 13.29 % failures were Class IV which include failures associated with caries, fracture of supporting tooth structure, or a defective foundation. 12.65 % failures were identified as class II which include failures and loss of supporting tooth structure resulting from caries or fracture. Fractures can also occur during attempts to remove a restoration.

Table 2: Distribution of patients according to frequency and percentage from class I to VI

Class	Frequency	Percent
I	9	5.7
II	20	12.7
III	51	32.3
IV	21	13.3
V	19	12.0
VI	38	24.1
Total	158	100.0

Fig 1: Class I failure. Porcelain fused to metal crown lacking occlusal contact. Crown replacement was not required since it was possible to remove and improve existing crown.

Fig 2: Crown in place with improved occlusal contact.

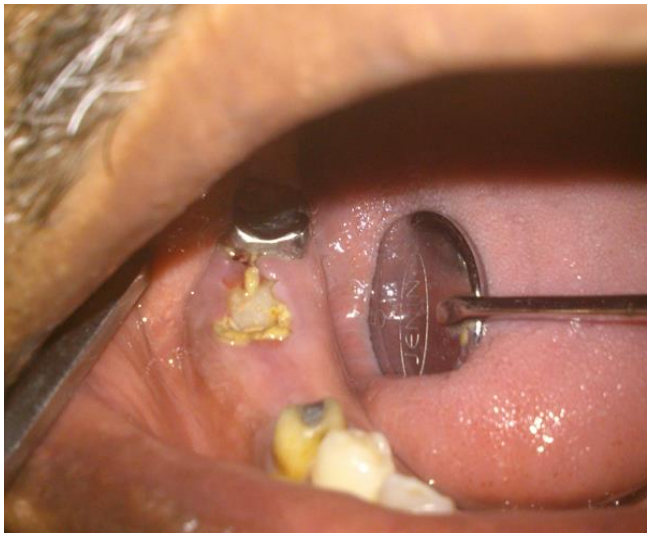


Fig 3: Class II failure, which involve repair or reconstruction of abutment tooth and, it is correctable without replacing existing restoration.

Fig 4: Class III Failure requiring restoration replacement only. Condition of supporting structure was satisfactory without additional treatment.

Fig 5: Failure occurs due to wrong pontic design (saddle/ ridge lap pontic).

Fig 6: Class IV Failure requiring restoration replacement due to fracture of retainer in addition to repair or reconstruction of abutment teeth.

Fig 7: Both maxillary lateral incisors require reconstruction.

Fig 8: Class V failure with loss of supporting teeth.

Fig 9: Inability to reconstruct FDP using original tooth support. FDP remain possible through use of additional tooth support.

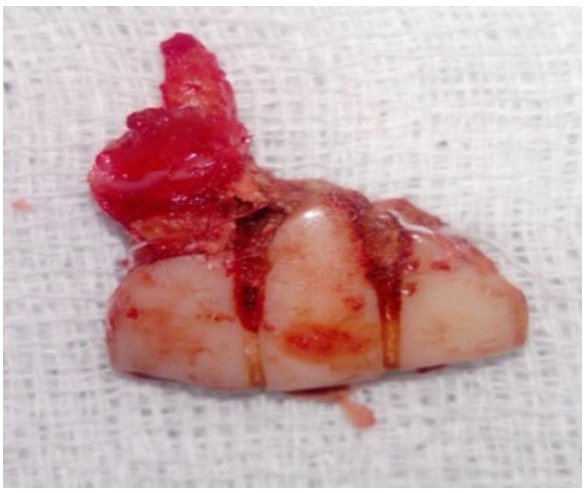
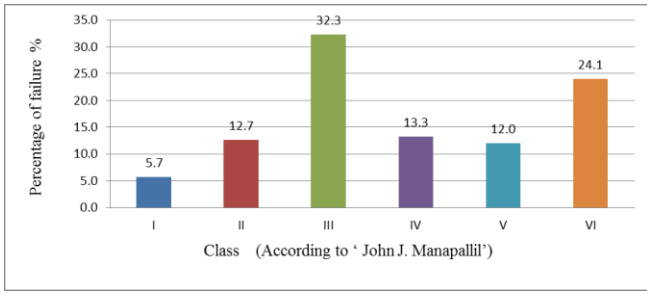


Fig 10: Failure of FDP with abutment tooth.

Fig 11: Class VI Failure in which Cantilever is given with the support of mandibular right second premolar and first molar.

Fig 12: Conventional fixed prosthodontic replacement is not possible in distal extension case.

Fig 13: Removal of cantilever.



Graph 1: Bar chart of percentage of failure divided in class I to VI according to John J. Manappallil's classification.

12.02 % failures were class V which included support structures that can no longer provide adequate support for the existing restoration due to extensive fracture, carious destruction, periodontal problems or other complications. Only 5.69 % failures were categorized in class I failures, which include the loss of a cement bond (Graph 1 and Table 2).

DISCUSSION

Fixed prosthodontic failures are varied and often complex in cause and effect. When a problem occurs, the design and condition of the restoration and associated structures must be considered[4]. When a crown or FPD fails, the primary question is whether the problem can be easily resolved, or requires extensive rehabilitation and reconstruction. A mild failure may be considered one that is generally correctable without having to remake the restoration. More severe failures can result in the loss of supporting teeth. Knowledge of the background factors and conditions that cause FDP to become unserviceable should help dentists in their prosthetic treatment planning. Furthermore, a more reliable prognosis might be possible. In recent years, several investigators have taken great interest in investigating the life span and long-term quality of fixed dentures[5]. An analysis of all failure types, point to the direction that adherence to the basic principles of tooth preparation namely biological, mechanical and esthetic that considerably improves the prognosis, is of almost importance in predicting the success of final restoration.

The primary advantages of John J. Manappallil's classification system are that it is simple, practical and applicable in all failure situations concerning FDP. The system identifies failure by the degree of severity and considers conventional retreatment possibilities[3].

Class I failures are correctable through occlusal adjustment or composite resin repairs without requiring replacement of the restoration. In a Class II failure, the restoration itself is acceptable; however, the supporting tooth structure or foundation (core restoration, or post and core) requires repair or reconstruction. Restoration replacement is required with Class III failure; however, the supporting tooth structure or foundation remains intact and would provide acceptable support for a replacement restoration. In Class IV situations, the restoration requires replacement, and the supporting tooth structure or foundation is deficient. In a Class V failure, support structures can no longer provide adequate support for the existing restoration due to extensive fracture, carious destruction, periodontal problems, or other complications. A Class VI failure is the most severe failure; in this situation, a conventional fixed replacement is no longer possible because of abutment failure and the lack of additional support for use in a redesigned restoration.

Earlier literature has evaluated caries as the most common cause for fixed dental prosthesis failure[6-11]. Some studies have shown that periodontal disease is most common cause for bridge failure[12], but according to this research study unserviceable restorations due to defective margins, technical failures or esthetic considerations were the most common cause among studied Indian population.

Microbial dental plaque has been shown to play a major role in the pathogenesis of gingivitis. Fixed partial dentures make oral hygiene efforts more difficult, especially for those in the posterior arch. If the pontic design is not adequate, it interferes with proper oral hygiene due to plaque accumulation. Subpontic tissue changes that are proportional to the increase of the adaptive pressure occur. A rough surface facilitates the accumulation and retention of dental plaque even more. All this has a direct relationship with gingival health[13].

The guidance of clinician in deciding the pontic design is as important as fabricating the well-fitting prosthesis. The ideal pontic design suggested for maxillary and mandibular anterior teeth and maxillary premolars and first molars is Modified Ridge lap because it combines the best features of the hygienic and saddle pontic designs, combining esthetics with easy cleaning. Sanitary/Hygienic pontic design should be used for mandibular molars because it allows easy cleaning, as its tissue surface remains clear of the residual ridge and permits easier plaque control by allowing gauze strips and other cleaning devices to be passed under the pontic and seesawed in a shoeshine manner, but it is the least "tooth-like" design and is therefore reserved for teeth seldom displayed during function. Conical pontic should be selected for mandibular posterior teeth with knife-edged residual ridge because it is easy for the patient to keep clean due to only one point of the contact at the center of the residual ridge and more over esthetic appearance is less of concern in this area. This type of design may be unsuitable for broad residual ridge, as the emergence profile associated with the small tissue contact point may create areas of food entrapment. The esthetics sometime requires the use of ovate pontic design in anterior teeth after extraction especially in patient with high smile line. Saddle/ Ridge lap pontic design should not be used under any circumstances[1,2,14].

Patient should be instructed for special plaque control measures, especially around pontics and connectors and the use of special oral hygiene aids such as floss threaders should be advised. If the pontics are properly designed, floss can be looped through the embrasure spaces on each side during cementation and after care, and the loop can be pulled tightly against the convex pontic tissue surface. A sliding motion is then used to remove dental plaque. Flossing under pontics is essential for improving prosthesis longevity. When dental floss is used, the mucosa beneath pontics remains healthy; without it, mild or moderate inflammation results[1,15].

CONCLUSION

Most failures of FDP require replacement of restoration, the causes for replacement being wrong pontic design, defective margins or esthetic considerations. This makes it mandatory for clinician to take due interest in laboratory phase of restoration along with laboratory technician, which involve proper designing of pontic, marginal fit and occlusion.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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