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EVALUATION OF DENTIST'S SATISFACTION OF MARGINAL FIT IN FIXED PARTIAL DENTURES FABRICATED USING CAD/CAM SYSTEMS - AN INSTITUTION BASED RETROSPECTIVE STUDY

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Abstract

Accuracy and quality of CAD CAM in producing fixed partial dentures, crowns and bridges is acceptable and improving every day. Marginal adaptation is one of the most important factors for success and clinical longevity of the treatment. The aim of this study was to retrospectively evaluate the dentist's satisfaction of marginal fit in fixed partial dentures fabricated using CAD/CAM systems. The data for this study was collected from June 2019 to March 2020 at a private dental institution in Chennai. A total of 507 patients who received fixed partial dentures were included in the study. Data regarding the marginal fit in relation to each sextant was collected from the case record. Chi-square test was applied to see associations of marginal fit satisfaction in each sextant. The results showed that 94.1% (n=477) of the fixed partial dentures a satisfactory marginal fit, while the marginal fit in 5.9% (n=30) of the FPDs were non satisfactory. Fixed partial dentures in sextant 2 showed 30% (n=9) non satisfaction followed by sextant 1 with 20% (n=6). The findings of this study shows that the FPDs fabricated using CAD/CAM systems had a satisfactory marginal fit and comparatively sextant 2 presented with high marginal misfit than the other sextants.

Keywords: *CAD/CAM system; Dentist's satisfaction, Fixed partial denture; Marginal fit.*

Introduction

Nowadays, patients are well aware of his or her treatment options, and CAD/CAM technology may help the dentist meet such a patient's needs. With access to well designed software, attention to user-friendliness and positive clinical performance history, CAD/CAM systems are a significant stride forward into advanced dental treatment [1]. Accuracy and quality of CAD CAM in producing fixed partial dentures, crowns and bridges is acceptable and improving day by day [2]. This helps the clinicians to maintain total product and artistic control

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of the restorations to be fabricated and seated. The designing softwares deliver a product that may need only endpoint characterization, staining or glazing. The computer and milling processes diminish the potential inaccuracies that are usually seen in lost wax technique and are able to provide a restoration that fits within the 50-micrometer range established by the American Dental Association [3,4].

Fixed partial denture is a common practise over ages for replacing missing teeth. Marginal adaptation is one of the most important factors for the success and clinical longevity of Fixed partial dentures. Inadequate fit leads to accumulation of plaque, which increases the risk of periodontal diseases [5]. Misfit could contribute to cement dissolution resulting in caries and endodontic inflammation [6]. Some clinicians remain reluctant to incorporate CAD/CAM technology into their practices despite its increasing popularity. One of the main concerns relates to the size of the marginal gap that occurred in many of the restorations produced by the early CEREC systems. The fit of earlier versions of CAD/CAM restorations has been reported by some authors and clinicians [7]. Some clinicians have even associated the poor fit of older systems with recently introduced products when, in fact, marginal adaptation has been vastly improved and can exceed that of conventional laboratory methods [8]. Modern CAD/ CAM technology has been shown to allow the fabrication of better fitting partial fixed dental prostheses and implant frameworks than those made with the traditional techniques [9]. Studies agree that the fit of the CAD/CAM restoration rivals that of conventionally fabricated restorations.

Different methods have been used to assess marginal and internal adaptation of indirect restorations. Clinically, marginal fit can be estimated directly using a probe with known dimensions, a dental mirror, and adequate illumination and magnification. Marginal fit can also be indirectly evaluated radiographically, and through epoxy resin replicas by light and scanning electron microscopy [10]. There is no consensus on which is the best method to evaluate marginal and internal adaptation of indirect restorations. There are various studies comparing marginal fit of FPDs fabricated using different techniques and materials. But there are very few studies that analyse dentist's satisfaction of marginal fit in FPDs in different sextant. The objective of this study was to retrospectively evaluate the dentist's satisfaction of marginal fit in fixed partial dentures fabricated using CAD/CAM systems .

MATERIALS AND METHODS:

This retrospective study was conducted from June 2019 to March 2020, in the Department of Prosthodontics, in a private dental institution in Chennai, after taking ethical clearance from the Institutional Review Committee. Case records of patients who underwent Fixed partial denture treatment were collected and the missing entries were omitted (Purposive sampling). So a total of 507 case records were obtained. Written informed consent was taken from each patient participating in the study. Case sheet of each patient included age, chief complaint, history of presenting illness, relevant medical and dental history, intraoral and extraoral examination, treatment plan, preoperative and post-operative radiographs and photographs and an elaborate summary of the treatment procedure done on the patient. It had a separate column for the dentist's opinion on the treatment. So the data on the marginal fit of FPDs were collected. Photographs and radiographs were used for cross verification of data to reduce errors. To minimise the sampling bias, the study was double blinded by an analyser and a reviewer.

After well refined tooth preparation, gingival retraction was done using Ultrapak™ knitted cord. Double cords were used during cord packing. Double stage putty wash impressions were taken using Virtual®Putty and Ivoclar Vivadent Virtual Refill Light Body Regular Set VPS Impression Material. The master cast of all the patients were scanned using the Medit T series extraoral scanner, and the framework was designed in 3 shape software. The STL file was then imported to I MES I CORE milling machine and sintered.

The collected data was entered in Microsoft Excel 2010 and a specific statistical software, IBM SPSS 19.0 version was used to analyse the data. Descriptive statistics was performed for each group and Chi-square test

was performed to see the association between satisfaction among different sextants.

RESULTS:

A total of 507 case reports were examined among whom 298 (58.8%) were male and 209 (41.2%) were female aged between 20-60 years (figure 1). The results showed that 93.88% (n=476) of the fixed partial dentures fabricated using CAD/CAM system had a satisfactory marginal fit, while the marginal fit in 6.11% (n=31) of the FPDs were non satisfactory (figure 2). Chi square test was used to determine the association of marginal fit satisfaction and sextant and was found to be statistically significant (p Value = 0.01) was obtained. The study reported that the marginal fit was highly satisfactory in sextant 6 and sextant 5 with 25.0% and 24.79% respectively, followed by sextant 4 with 19.33%, sextant 3 with 15.76%, sextant 1 with 11.76% and 3.36% in sextant 2. It was observed that sextant 2 had a non-satisfactory fit of 32.26% followed by sextant 1 with 19.35%, sextant 5 with 16.13%, sextant 3 with 12.9%, sextant 6 and 4 with 9.77% (figure 3, table 1).

DISCUSSION:

Previously our team has conducted numerous original studies over the past 5 years [11–25]. The idea for this study stemmed from the current interest in our community. Marginal fit is an essential aspect that determines the success of a fixed partial prosthesis. Failure of FPD bridges usually occur due to improper case selection, faulty diagnosis and treatment plan, inaccurate clinical and laboratory procedures and poor patient care and maintenance following insertion [26]. This study retrospectively evaluated the dentist's satisfaction of marginal fit in fixed partial dentures fabricated using CAD/CAM systems. The results showed a statistically significant correlation between the marginal fit of FPDs and dentist's satisfaction. According to the results, about 93.8% of the bridges showed satisfactory marginal fit and very meger numbers showed non satisfactory marginal fit. This is in accordance to the results found by various studies that reported that the marginal fit of CAD/CAM restoration is within the limits considered clinically acceptable by ADA specification #8, therefore milled CAD/CAM crowns can be considered a good alternative to more traditional waxing-investing-casting technique [27–29]. The potential reason for this non satisfactory fit has to do with the diamond rotary cutting instruments that the current CAD/CAM mills use and their inability to replicate the features caused by these preparation errors. Furthermore, Renne et al emphasised that, when milling the restorations, variables within the mill itself, such as diamond rotary cutting instrument wear and water quality, may affect the quality of the restoration [30]. It should be noted that minor errors in designing softwares and scanners can also add on to the marginal misfit.

The results of the present study reported that dentists found satisfactory marginal fit of the FPDs in sextant 5 and sextant 6. Sadatullah et al reported that most of the dentists considered maxillary teeth preparation to be more difficult than mandibular teeth reduction [31]. Maximum misfit was observed in sextant 2 followed by sextant 1. This could probably be because of the curvature of the arch in the upper anterior region. But Pound et al, reported that achieving success in the lower anterior bridge was more difficult [32]. Nowadays there is an increase in the number of laboratories using CAD/CAM systems to fabricate fixed partial dentures and may also have similar issues with poor preparations. Errors in preparation design, particularly involving the margin, are easier to cope with when a laboratory uses the lost wax technique to fabricate alloy restorations [30]. However it is worth noting that all preparations were thoroughly examined by experienced clinicians. However, it is the hope of the authors that clinicians will be able to recognize and correct these common preparation errors in order to improve the overall fit of their restorations.

Since this study was conducted in an institution-based set-up and the sample size is small, this might bias the study results, as the selected sample is not representative. The inclusion and exclusion criteria were not well specified and the abutment conditions were not evaluated. Hence, further studies are required to explore about the marginal fit of CAD/CAM milled restorations.

"The ideal CAD / CAM system" for many years is a dream of many researchers. The data observed from this retrospective study provides the clinicians with the information regarding the performance of CAD/CAM systems in marginal adaptation.

CONCLUSION:

Within the limitations of this study it was observed that the marginal fit of CAD/CAM milled fixed partial dentures were satisfactory. Among the sextants, satisfactory marginal fit was reported in sextant 5 and 6, maximum marginal discrepancy was seen in sextant 2 followed by sextant 1.

AUTHOR CONTRIBUTIONS:

Dr. Harini Sri

Author contributed in the conception, design, acquisition of data, analysis, drafting the article and interpretation of data.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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GRAPHS:

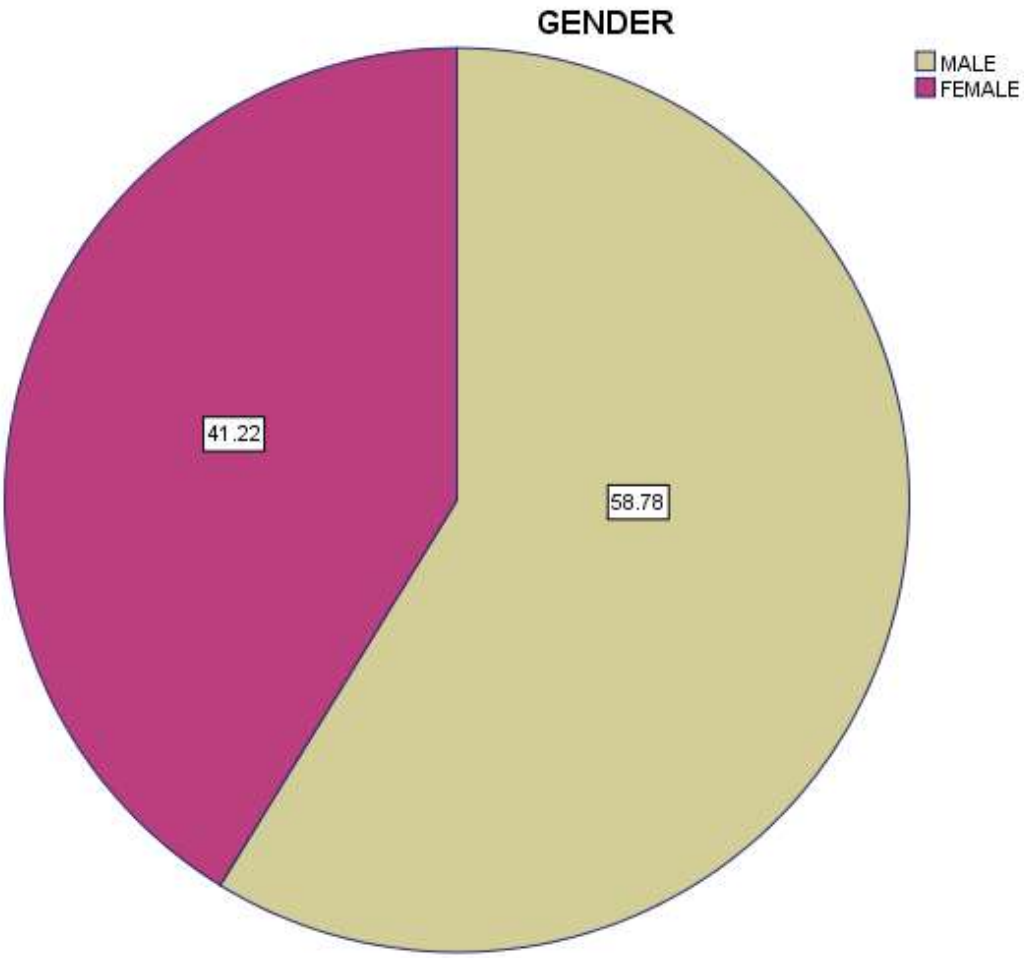

Figure 1: Gender distribution in the study in percentage. Brown colour represents male and purple represents female participation in the study in percentage. 41.2% of female (n=209) and 53.78% (n=298) of male participated in the study.

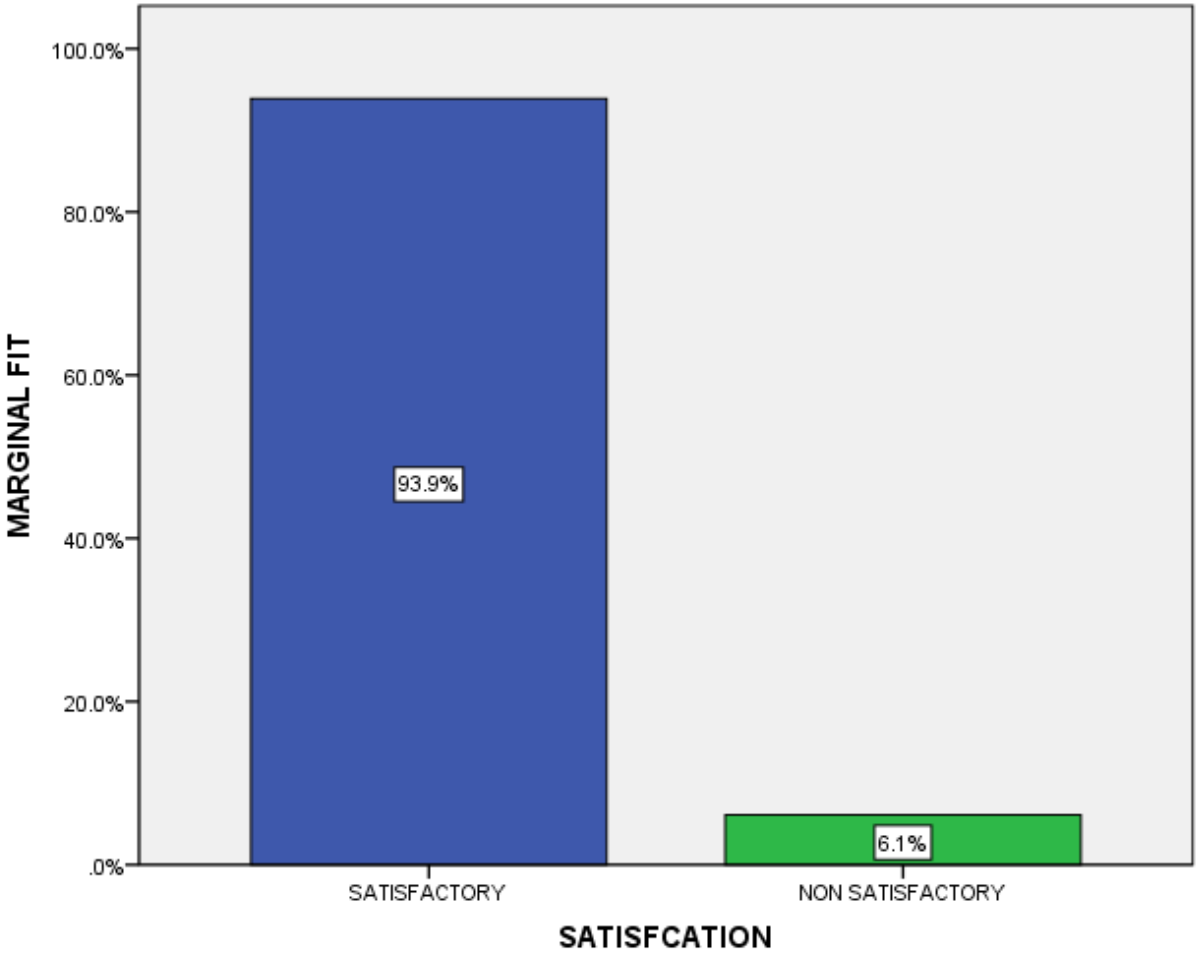

Figure 2: Frequency of satisfaction of marginal fit. X - axis depicts satisfaction of marginal fit among dentists and Y - axis shows the percentage of Fixed Partial Denture. It was observed that 93.88% (n=476) of the fixed partial dentures fabricated using CAD/CAM system had a satisfactory marginal fit (blue), while the marginal fit in 6.11% (n=31) of the FPDs were non satisfactory (green).

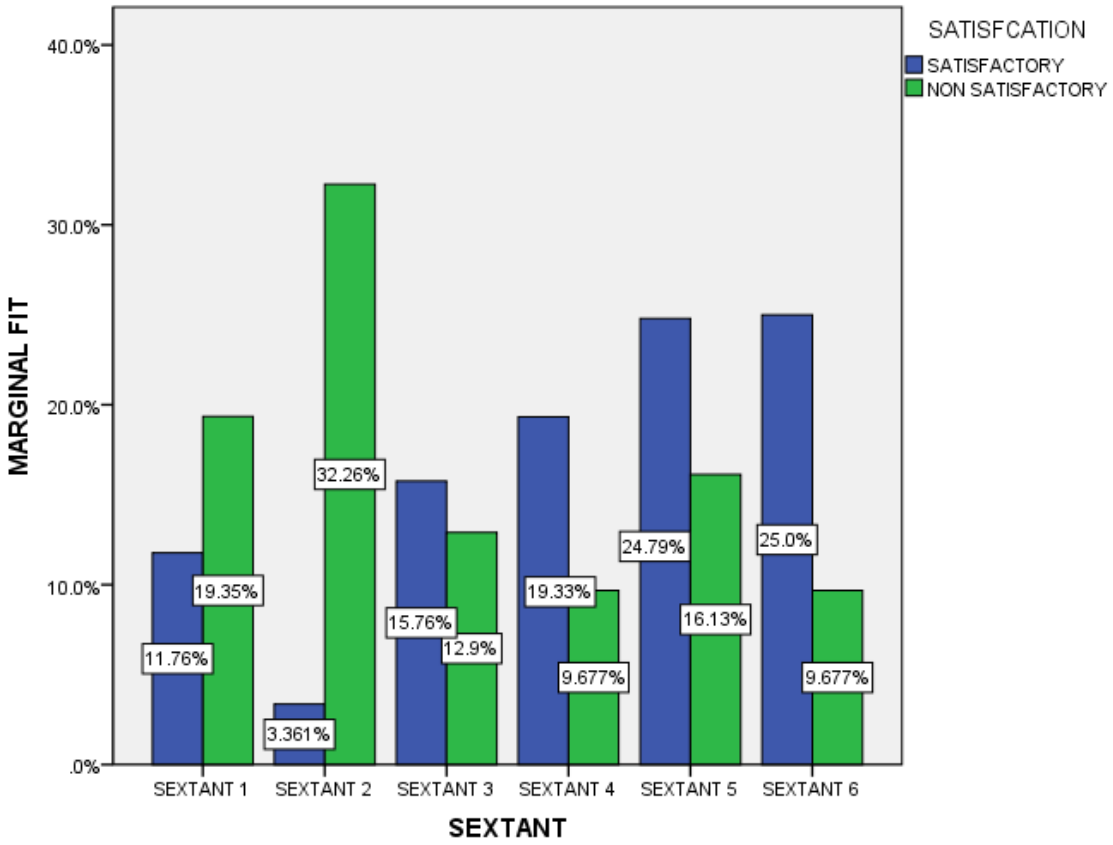

Figure 3 : Satisfaction of marginal fit in each sextant. X - axis depicts the sextant and Y axis represents the percentage of satisfaction of marginal fit. It is observed that the marginal fit was highly satisfactory (blue) in sextant 5 and sextant 6 with 24.79% and 25.0%. Sextant 2 had a non-satisfactory fit (green) of 32.26% followed by sextant 1 with 19.35%. Chi square test was used to determine the association of marginal fit satisfaction and sextant and was found to be statistically significant (p value = 0.01) was obtained.

TABLES:

SEXTANT	MARGINAL FIT				TOTAL	
	SATISFACTORY		NON SATISFACTORY			
	COUNT	%	COUNT	%	COUNT	%
SEXTANT 1	56	11.8%	6	19.4%	62	12.2%

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SEXTANT 2	16	3.4%	10	32.3%	26	5.1%
SEXTANT 3	75	15.8%	4	12.9%	79	15.6%
SEXTANT 4	92	19.3%	3	9.7%	95	18.7%
SEXTANT 5	118	24.8%	5	16.1%	123	24.3%
SEXTANT 6	119	25%	3	9.7%	122	24.1%

Table 1: Satisfaction levels in each sextant. Marginal fit was satisfactory in sextant 5 and sextant 6 with 24.79% and 25.0%. Sextant 2 had a non-satisfactory fit of 32.26% followed by sextant 1 with 19.35%. Chi square test was used to determine the association of marginal fit satisfaction and sextant and was found to be statistically significant (p value = 0.01) was obtained.

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