Type of Research : Retrospective study

Prevalence of Vitality in Fixed Partial Denture Done by the Undergraduates - A Retrospective Study

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Abstract

Fixed partial denture is any dental prosthesis that is luted, screwed, or mechanically attached or otherwise securely retained to natural teeth, tooth roots, and/or dental implants/abutments that furnish the primary support for the dental prosthesis and restoring teeth in a partially edentulous arch; it cannot be removed by the patient. This study is aimed to evaluate prevalence of vitality of pulp before and after tooth preparation done by undergraduates for fixed partial denture. A retrospective study was done in which 955 teeth were prepared for fixed partial denture from 1 June 2019 till 1 March 2020 were included. Data was reviewed from the patients records of 86,000 patients documented in a private institution. Statistical analysis was performed to assess the vitality of pulp before and after tooth preparation done by undergraduates for fixed partial denture. There was a statistically significant difference when postoperative vitality was compared in different age groups ($p<0.05$). Out of 200 abutments that were non vital postoperatively only 48% of the abutment had indication for endodontic therapy. Lack of experience of dental students can be the reason for pulpal exposure during preparation. It might be difficult for students to get the parallelism of the abutments mainly in the multiunit fixed dental prosthesis. Treatment planning should be done carefully along with the students and a beforehand mock preparation should be done on plaster models instead of direct preparation of the vital abutments, this can also help students to perform different types of treatments adequately.

Keywords: *Vitality, Abutment, Fixed Partial Denture, Pulpal Exposure.*

Introduction

Fixed partial denture is any dental prosthesis that is luted, screwed, or mechanically attached or otherwise securely retained to natural teeth, tooth roots, and/or dental implants/abutments that furnish the primary support for the dental prosthesis and restoring teeth in a partially edentulous arch; it cannot be removed by the patient [1]. They are used mainly for replacing missing teeth or teeth for which fixed partial dentures have had insults from caries, trauma, any periodontal disease [2]. Dental pulp health can be affected by dental disease, trauma and restoration and further treatment of these problems can lead to various pulpal tissue degenerative problems [3]. Failures of Fixed Dental Prosthesis include biologic failures which include endodontic problems of the abutment, caries or any periodontal problems [3,4,5,6.] Mechanical failures of Fixed Dental Prosthesis include loss of retention, failure of porcelain, open margins of the framework, wear of ceramic, poor contours, poor margins, fracture of the abutment, etc. These failures can have a detrimental effect on the health of the pulp [7, 8].

There are various studies which have shown pulp necrosis after fabrication of Fixed Dental Prosthesis [9–11]. A study done by Bergenholtz & Nyman [9], had observation period of 8.7 years in which patients treated for advanced periodontal disease were reviewed and out it was found that 15% of the abutment teeth had pulpal necrosis, compared with only 3% in teeth which were not used as abutment.In a study done by Cheung *et al*, 4% of vital teeth developed pulpal necrosis after placement of single crowns [12, 13]. Other studies reported that 5.7% of teeth had received root canal treatment after 1–6 years of cementation of fixed dental prosthesis [11, 14] .

Fixed Dental Prosthesis preparation can have a detrimental effect on pulpal integrity, even though

preparation is kept as conservative as possible [15,16]. Detrimental effects are mainly due to the preparation process as it involves cutting of enamel and dentin, which leads to destruction of the odontoblastic process [17, 18]. This effect is further increased due to impression techniques used, which require drying the cut surface of the dentin [19, 20]. Bacteria are present in the form of saliva and carry almost continuously in the entire process from preparation till the final cementation and even after cementation if there are open margins present [7, 21, 22]. The literature shows that each step in the fabrication of a fixed prosthesis can potentially insult the pulp [11, 5]. This study was done for evaluation of prevalence of vitality of pulp before and after tooth preparation done by undergraduates for fixed partial denture.

Material and Methods

A retrospective study was done in a private institution. Ethical clearance number was SDC/SIHEC/2020/DIASDATA/0619-0320. The clinical portion of this retrospective study was conducted over a 9 month period i.e from 1 June 2019 to 1 March 2020 and included patients who had undergone Fixed Partial Dentures treatment. A total of 955 Fixed Partial Dentures were fabricated.

Inclusion Criteria : Patient undergoing FPD, age within 25 to 50 years, both male and female.

Exclusion Criteria: Single crowns, Implant placement patient, FPD done by post graduates.

The data of 86,000 patients documented between June 2019 and March 2020 were reviewed and analysed. The data collected was entered, tabulated and analysed for seeing the prevalence of vitality of pulp before and after tooth preparation done by undergraduates for fixed partial denture. Statistical analysis was done using SPSS Statistics Software for windows, version 20.0. Pearson correlation was done to determine that is there any statistical significant difference between vitality of pulp before and after tooth preparation done by undergraduates for fixed partial denture.

Results and Discussion

Out of 955 patients, 28% Fixed Dental Prosthesis were done in the age group of 26-35 years. 59.6% of the patients were Males. Out of the total population 79% abutments were vital at the end of the treatment.

Association between gender and preoperative condition of abutment showed no significant difference with Chi-square value of 3.076. There was no significant association between gender and postoperative vitality of abutment used for fixed partial denture (p value.0.05) (Table 1).

Similarly association between postoperative vitality with its preoperative condition according to gender had no significant association (Table 2). Association between age and preoperative condition of abutment had no significant relation ($p>0.05$). But association between age and post operative vitality of the abutment teeth was statistically significant ($p<0.05$) (Table 3, Figure 1). Association between postoperative vitality of abutment teeth with its preoperative condition according to age had statistically significant association (Table 4). Association between preoperative condition of abutment teeth and postoperative vitality of abutment showed no significant relation (Table 5, Figure 2).

This study aimed to evaluate the number of abutments going for endodontic therapy during Fixed Denture Prosthesis treatment done by undergraduates. There are many prospective studies that are done on endodontic treatment requirements for prosthetic treatments, but very few studies examine the vitality of the pulp preoperative and postoperative and pulpal exposure during tooth preparation [23, 24].

When the preoperative condition of teeth was not approaching pulp in the age group of 18-25 years many pulpal exposure were seen during preparation, this can be due to high level of pulp chamber in young adults. In a study done by Uzgur et al [25] showed that the incidence of vital abutment teeth that required endodontic therapy during the tooth preparation stage was about 0.7%. These results were similar to other studies done [0.6%] [26, 27].

Tooth preparation according to its principle is difficult as it involves making the wall of the abutment parallel to each other [28]. It is difficult when teeth are not aligned properly. Primary failures in Fixed partial denture fabricated by dental students occur mainly due to lack of experience [29]. Earlier studies were done by dentists rather than dental students.

According to the available literature 3-38% of the teeth that undergo fixed partial denture treatment have undergone pulp necrosis. However, the only clinical study that has checked the loss of vitality of the abutment during the time of preparation was done by Napankangas et al [30] and one retrospective study done by Raustia et al [29].

In our study, there was a significant difference seen when the postoperative vitality was compared according to age. In young patients the pulp chamber is higher than older patients, hence chances of exposure are more and therefore tooth preparation should be kept minimal mainly in the anterior region [31, 32]. As if the pulp is exposed it needs to undergo endodontic treatment which is assumed to weaken the abutment teeth. In a previous study it has been noted that on long term follow up, if the abutment is endodontically treated before or during tooth preparation it has to undergo extraction [33]. Hence, maintaining the vitality of pulp is an important factor that should be considered during tooth preparation. There are many clinical variables that can affect the exposure of abutment, but it is difficult to develop a causal relationship, hence its difficult to determine the factors that cause pulpal exposure during tooth preparation and factors that can prevent exposure [29]. Lack of experience of dental students can be the reason for pulpal exposure during preparation. It might be difficult for students to get the parallelism of the abutments mainly in the multiunit fixed dental prosthesis. Treatment planning should be done carefully along with the students and a beforehand mock preparation should be done on plaster models instead of direct preparation of the vital abutments, this can also help students to perform different types of treatments adequately.

Limitation of our study is that it is done in an institutional setting, hence there are limited samples. As it is an institutional study there can be operator bias, protocol bias seen. The clinical scenarios during fixed partial denture tooth preparation in our study were not the same as there were different operators and different clinical conditions.

Table 1: Association between gender and preoperative condition of teeth, gender and postoperative vitality of teeth. Chi-square test was done, p value was 0.063 showing that it is statistically not significant, proving that there is no association between gender and preoperative condition, gender and postoperative vitality of teeth.

		Gender		Chi-square value	P value
		MALE	FEMALE		
Preoperative Condition of teeth	Approaching Pulp	49.4%	44.1%	3.076	0.215
	Not Approaching Pulp	50.6%	55.9%		
Postoperative Vitality	Vital	74.9%	67.1%	5.534	0.063
	Non Vital	25.1%	32.9%		

Table 2: Association between preoperative condition of teeth and postoperative vitality of teeth after fixed partial denture was done according to gender. Chi-square test was done, p value was 0.277 and 0.08 showing that it is statistically not significant, proving that there is no association between preoperative condition of teeth and postoperative vitality of teeth after fixed partial denture was done according to gender.

			Gender		Chi-square value	P value
			MALE	FEMALE		
Preoperative Condition of teeth	Approaching Pulp	Vital	74.2%	66.7%	2.566	0.277
		Non Vital	25.8%	33.3%		
	Not Approaching Pulp	Vital	75.7%	67.5%	3.067	0.080
		Non Vital	24.3%	32.5%		

Table 3: Association between age and preoperative condition of teeth, age and postoperative vitality of teeth. Chi-square test was done, p value was 0.000 showing that it is statistically significant, proving that the 26-35 year age group had more vital teeth after preparation was done for fixed partial denture. Association between preoperative condition of teeth with age had p value of 0.47 showing that it is statistically not significant.

		Age (%)					Chi-square value	P value
		18-25	26-35	36-45	46-55	Above 55		
Pre operative Condition of teeth	Approaching Pulp	45.7%	51.3%	48.2%	40.4%	47.6%	3.548	0.47
	Not Approaching Pulp	54.3%	48.7%	51.8%	59.6%	52.4%		
Postoperative Vitality	Vital	59.1%	82.4%	70.7%	77.1%	61.9%	26.94	0.00*
	Non Vital	40.9%	17.6%	29.3%	22.9%	38.1%		

*The Chi-square is statistically significant at the 0.05 level.

Table 4: Association between preoperative condition of teeth and postoperative vitality of teeth after fixed partial denture was done according to age. Chi-square test was done, p value was 0.036 showing that it is statistically significant, proving that in the age group of 46-55 years though the preoperative condition of teeth was approaching pulp, the postoperative vitality was maintained after preparation for fixed partial denture. Association between teeth with ideal tooth structure and postoperative vitality had p value of 0.001 showing that the association is statistically significant, proving that in the age group of 18-25 years there were more pulpal exposure seen during tooth preparation.

			Age					Chi-square value	P value
			18-25	26-35	36-45	46-55	Above 55		
Preoperative Condition	Approaching Pulp	Vital	62.1%	79.4%	67.4%	81.8%	62.5%	10.30	0.036*
		Non Vital	37.9%	20.6%	32.6%	18.2%	37.5%		
	Not Approaching Pulp	Vital	56.5%	85.6%	73.7%	73.8%	61.4%	19.86	0.001*
		Non Vital	43.5%	14.4%	26.3%	26.2%	38.6%		

*The Chi-square is statistically significant at the 0.05 level.

Table 5: Association between preoperative condition of teeth and postoperative vitality of teeth used as abutment for fixed partial denture. Chi-square test was done, p value was 0.821 showing that it is statistically not significant, proving that there is no association between preoperative condition of teeth and postoperative vitality of teeth used as abutment for fixed partial denture.

		Preoperative Condition of teeth		Chi-square value	P value
		Approaching Pulp	Not Approaching Pulp		
Postoperative Vitality	Vital	71.4%	72.2%	0.051	0.821
	Non Vital	28.6%	27.8%		

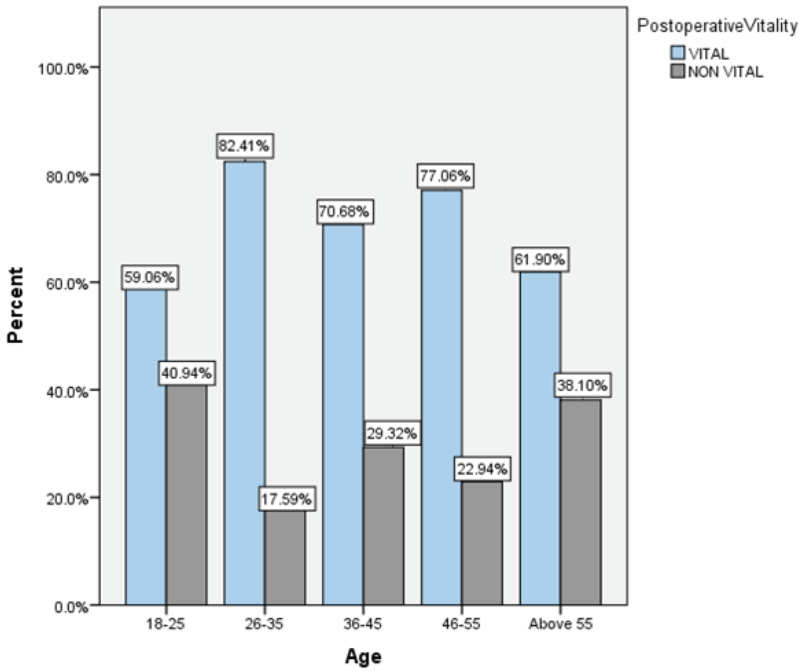

Figure 1: Bar graph showing association between age and postoperative vitality of teeth. X-axis represents different age groups involved in this study and Y-axis represents percentage distribution of postoperative vitality of teeth. Blue colour represents vital teeth postoperatively and Grey colour represents non vital teeth postoperatively. Chi-square test was done and association was found to be statistically significant. Pearson's Chi-square value: 26.946, p value: 0.000 (<0.05) hence statistically significant, proving that postoperative vitality varies in different age groups with highest frequency in the age group of 26-35 years.

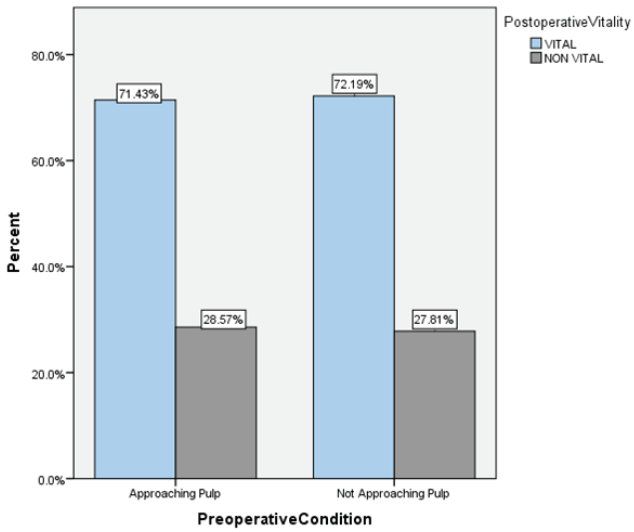

Figure 2: Bar graph showing association between preoperative condition of teeth and postoperative vitality of teeth for abutments used for fixed partial denture. X-axis represents the preoperative condition of teeth and Y-axis represents the percentage of postoperative vitality of teeth. Blue colour represents vital teeth postoperatively and grey colour represents non vital teeth postoperatively. Chi-square test was done. 72.19% of teeth which were not approaching pulp were vital after fixed partial denture treatment was done. Pearson's Chi-square value: 0.51, p value: 0.821 (>0.05) hence is statistically not significant, proving that there is no association between preoperative condition of teeth and postoperative vitality of teeth for abutments used for fixed partial denture.

Conclusion

Vitality of the abutment is the most important factor deciding the longevity of the prosthesis. Various factors have influence of abutment vitality before fixed dental prosthesis cementation is done. Tooth preparation should be done minimally and vitality of the abutment should be preserved. The study concludes that most common failures of fixed metal ceramic bridges made by dental students occur during preparation of abutment teeth which can be avoided by proper treatment planning and before preparation should be done on a gypsum model.

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Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

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