A QUESTIONNAIRE-BASED SURVEY ASSESSMENT OF DENTISTS FOR REPAIR VERSUS REPLACEMENT OF DEFECTIVE RESTORATIONS

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ABSTRACT

Objective: *To determine the practice of dentists for management of defective restorations. This cross-sectional survey was conducted on 124 qualified dentists who were either government employees or private practitioners, house officers, post graduate residents and fellows. Undergraduate dental students, dental technicians and dental assistants were excluded from the study. The questionnaire contained all close ended questions and was distributed through emails and whatsapp.*

Methodology: *The practice of managing defective restorations was compared among various level of experiences using chi-square test. The mean age was 33.95±7.65 years. The males were 79(63.71%) and females were 45(36.29%). Of total 77(62.10%) dentists frequently repair single tooth defective restorations. For 91(73.39%) dentists, the outcome of repaired restoration was satisfactory.*

Results: *The common reasons for repair of defective restoration was to 'prolong life of restoration' (n=54, 43.55%) and conservation (n=38, 30.65%). Most common reason for defective amalgam restoration was 'Tooth Fracture' (n=54, 43.55%) and for composite was 'Secondary Caries' (n=42, 33.87%). Statistically significant association was found between restorations placed and years of experience (p=0.001). Dentists with more experience were repairing more single tooth restorations as compared to less experienced statistically (p<0.001). In conclusion, more than 62% dentists repair defective restorations. Amalgam restoration is repaired mainly due to tooth fracture and composite due to secondary caries. Experiences of dentists affect their practice of managing defective restorations.*

Keywords: *Male, Female, Cross-Sectional Studies, Chi-Square Distribution, Dental Assistants, Dental Caries Susceptibility, Dental Technicians, Electronic Mail, Government Employees, Students, Dental Surveys and Questionnaires, Dentists, Tooth Fractures*

INTRODUCTION

Dentition is of paramount significance to masticate, phonate and communicate.[1] Tooth structure can be lost due to carious lesion and trauma.[2] The defective tooth structure is restored after removal of carious lesion.[3] The aim of restoration is to prevent further damage to tooth structure and restoration of anatomy and function. The most commonly used materials are amalgam and composite for restoration.[4] Extensive research is ongoing to improve the materials for minimizing failure.[5]

Restorations fail due to many reasons; the reasons include factors related to dentist, patient such as habits, occlusion, and material factors.[6] The common reasons for restoration failure are secondary caries, discoloration, wear, marginal defects, and loss of anatomic tooth structure.[7]

In most instances, the dental restorations have a limited lifespan.[8] The defects that occur in existing restorations require management in routine dental practice.[9] The repair of amalgam is not ideal and one of

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the main advantages of composite resin over amalgam is the ease of repair.[7] The emerging concept in modern dental practice is to always consider the repair of old defective restorations rather than replacement.[10] The drawbacks of replacing existing restorations are pulpal irritation, increased loss of tooth structure, high cost and risk of tooth fracture due to weakened tooth.[11] Repair of restoration is more comfortable for patients as local anesthesia is not needed for this procedure. Repairing existing restorations is more conservative treatment option, it can increase the lifespan of restoration and is less costly than replacement.[12]

A questionnaire based survey on US population including 85 dentists found that 86.7% repair existing composite restoration while 16% replace it.[11] Another study on 1313 Norwegian Dentists reported that 26% repair composite restoration and 18.2% replace old restoration.[9]

There is an acute need to update the practice according to evidence based research. In Pakistan most of the dentists follow the conventional technique of treating patients. There is lack of research regarding whether to repair or replace the restoration.

The objective of this survey was to assess the knowledge of dentists for repair versus replacement of defective restorations

MATERIALS AND METHODS

This survey type cross sectional study was conducted on dentists of Islamabad and Rawalpindi from 1st February 2022 to 30th December 2022 by convenience sampling technique. The total sample size was 124 dentists calculated in WHO software using 6% margin of error, 95% confidence and 87.6% frequency (repair of existing composite restoration) from previous study.[11] The response rate was 89%.

The detail of study was incorporated at the start of questionnaire. The customized questionnaire was shared among dentists of Islamabad and Rawalpindi whatsapp groups of various institutes of Islamabad and through their personal emails (from their previous publication and through their peers). The response rate was about 80%.

The inclusion criteria were qualified dentists with registration number of Pakistan Medical and Dental Council, both government employees and private practitioners with any level of qualification such as house officers, postgraduate residents and fellows. Undergraduate dental students, dental technicians and dental assistants were excluded from the study.

The questionnaire contained all close ended questions; level of experience, number of restorations placed per week, type of restoration normally performed in their practice, their preference of material for single tooth repair, why they prefer repair of restoration, and how they repair amalgam restoration.

Data analysis was done in R Programming V 4.1.2. Numerical data was computed in the form of mean and SD and qualitative variables in term of frequencies with percentages. The practice of managing defective restoration was compared among various levels of experience using chi-square test. In case of 20% cells having count less than 5 then Fisher exact test instead of Chi-square test was run. The level of statistical significance was kept to p<0.05.

RESULTS

The mean age of dentists was 33.95±7.65 years. 79 males (63.71%) and 45 females (36.29%) participated in the study. The most common age group was 31-40 years having 50(40.32%) participants followed by 20-30 years having 46(37.10%). The most common level of experience of dentists was '>10years' (n=48, 38.71%) followed by 1-5years (n=36, 29.03%). (Table 1)

The common number of restorations placed per week by dentists was 5-10 (n=50, 40.32%) followed by 10-20 (n=46, 37.10) and least was '>20' (n=7, 5.65%). (Fig 1)

Most of the dentists responded that they are repairing single tooth restoration 'frequently' (n=77, 62.10%) followed by 'occasionally' (n=30, 24.19%). Most common outcome of defective restoration repair was 'satisfactory' (n=91, 73.39%). Nine (7.26%) dentists reported that their repaired restoration fractures and needs complete replacement and 9(7.26%) patients come with postoperative sensitivity and need complete replacement. When the dentists were asked about avoiding repairing single tooth restorations in certain situations, most of them reported that 'previous bad experience' (n=90, 72.58%) followed by 'lack of proper training' (n=23, 18.55%) and least common reason was 'bad experience of other dentists' (n=11, 8.87%). The most common repair of defective restoration was for composite (n=107, 86.29%) and least for amalgam (n=8, 6.45%). The common reasons for repair of defective restoration was to 'prolong life of restoration' (n=54, 43.55%) followed by 'conservation of tooth structure' (n=38, 30.65%). Most common decision factor for the repair of defective restoration was 'extent of defect' (n=70, 56.45%) followed by 'age of restoration' (n=24, 19.35%). (Table 2)

Most frequent reason for defective amalgam restoration which need repair was 'tooth fracture around restoration' (n=54, 43.55%) followed by secondary caries (n=36, 29.03%). For composite restorations the reason for repair was secondary caries (n=42, 33.87%) followed by 'partial loss of restoration' (n=35, 28.23%). Most

TABLE 1: DISTRIBUTION OF GENDER, AGE AND EXPERIENCE OF DENTISTS

Variable	Characteristic	n(%)
Gender	Female	45(36.29)
	Male	79(63.71)
Age group	20-30	46(37.10)
	31-40	50(40.32)
	41-50	28(22.58)
level of experience	<1yr	18(14.52)
	>10yr	48(38.71)
	1-5yr	36(29.03)
	5-10yr	22(17.74)

TABLE 2: PERCEPTION AND PRACTICE FOR REPAIR OF DEFECTIVE RESTORATION AMONG DENTISTS

Variable	Characteristic	n(%)
Repair done for single tooth restorations	Frequently	77(62.10)
	Never	7(5.65)
	Occasionally	30(24.19)
	Sometimes	10(8.06)
Outcome of repaired restoration in your experience	Dislodge & NCR	15(12.10)
	Fracture & NCR	9(7.26)
	Postop sensitivity & NCR	9(7.26)
	Satisfactory	91(73.39)
Why do you avoid repairing single tooth restorations in certain situations?	Bad experience of other dentists	11(8.87)
	Lack of training	23(18.55)
	Previous bad experience	90(72.58)
Which restoration you repair most frequently?	Amalgam	8(6.45)
	Composite	107(86.29)
	PFM	9(7.26)
Reason for repair of restorations	Patient's request	9(7.26)
	Prolong life span	54(43.55)
	Temporary measure	7(5.65)
	Time saving	16(12.90)
	Tooth structure conservation	38(30.65)
Decision to repair a restoration depends on?	Age of restoration	24(19.35)
	Extent of defect	70(56.45)
	Localization of the defect	10(8.06)
	Type of material	18(14.52)
	Type of tooth affected	2(1.61)

*Fisher exact test; ** NCR, Needs complete replacement

TABLE 3: REASON AND MATERIAL FOR REPAIR OF VARIOUS DEFECTIVE RESTORATIONS

Variable	Characteristic	n(%)
The reason for repair of amalgam restoration	Partial loss of restoration	34(27.42)
	Secondary caries	36(29.03)
	Tooth fracture around restoration	54(43.55)
The reason for repair of repair of composite restoration	Discoloration	21(16.94)
	Partial loss of restoration	35(28.23)
	Secondary caries	42(33.87)
	Shape adjustment	5(4.03)
	Tooth fracture around restoration	21(16.94)
The reason for repair of repair of PFM restoration	Chipping	21(16.94)
	Partial loss of restoration	35(28.23)
	Secondary caries	42(33.87)
	Shape adjustment	5(4.03)
	Tooth fracture around restoration	21(16.94)
The material used for amalgam repair	Amalgam	21(16.94)
	Composite	21(16.94)
	GIC	82(66.13)
The material used for composite repair	Composite	124(100.00)
The material for PFM repair	Acrylic	6(4.84)
	Composite	112(90.32)
	GIC	6(4.84)

TABLE 4: COMPARISON OF PERCEPTION AND PRACTICE FOR REPAIR OF DEFECTIVE RESTO-RATIONS AMONG DENTISTS BY LEVELS OF EXPERIENCE

Variable	Characteristic	<1yr, N = 18	>10yr, N = 48	1-5yr, N = 36	5-10yr, N = 22	p-value*
Repair done for single tooth restorations	Frequently	1(5.56)	39(81.25)	22(61.11)	15(68.18)	<0.001
	Never	2(11.11)	1(2.08)	1(2.78)	3(13.64)	
	Occasionally	12(66.67)	4(8.33)	11(30.56)	3(13.64)	
	Sometimes	3(16.67)	4(8.33)	2(5.56)	1(4.55)	
Outcome repaired restoration in your experience	Dislodge & NCR	3(16.67)	3(6.25)	6(16.67)	3(13.64)	0.14
	Fracture & NCR	3(16.67)	2(4.17)	1(2.78)	3(13.64)	
	Postop sensitivity & NCR	2(11.11)	1(2.08)	3(8.33)	3(13.64)	

Why do you avoid repairing single tooth restorations in certain situations?	Satisfactory	10(55.56)	42(87.50)	26(72.22)	13(59.09)	<0.001
	Bad experience of other dentists	3(16.67)	7(14.58)	1(2.78)	0(0.00)	
	Lack of training	12(66.67)	2(4.17)	4(11.11)	5(22.73)	
	Prev bad experience	3(16.67)	39(81.25)	31(86.11)	17(77.27)	
Which restoration you repair most frequently?	Amalgam	1(5.56)	2(4.17)	4(11.11)	1(4.55)	0.901
	Composite	16(88.89)	42(87.50)	30(83.33)	19(86.36)	
	PFM	1(5.56)	4(8.33)	2(5.56)	2(9.09)	
Reason for repair of restorations	Patient's request	2(11.11)	4(8.33)	2(5.56)	1(4.55)	0.07
	Prolong life span	4(22.22)	19(39.58)	20(55.56)	11(50.00)	
	Temporary measure	3(16.67)	3(6.25)	0(0.00)	1(4.55)	
	Time saving	5(27.78)	8(16.67)	0(0.00)	3(13.64)	
	Tooth structure conservation	4(22.22)	14(29.17)	14(38.89)	6(27.27)	
Decision to repair a restoration depends on?	Age of restoration	3(16.67)	8(16.67)	8(22.22)	5(22.73)	0.363
	Extent of defect	12(66.67)	21(43.75)	24(66.67)	13(59.09)	
	Localization of the defect	1(5.56)	5(10.42)	2(5.56)	2(9.09)	
	Type of material	2(11.11)	12(25.00)	2(5.56)	2(9.09)	
	Type of tooth affected	0(0.00)	2(4.17)	0(0.00)	0(0.00)	

*Fisher exact test; ** NCR, needs complete replacement

common reason for repair in porcelain fused to metal (PFM) was secondary caries (n=42, 33.87%) followed by 'partial loss of restoration' (n=35, 28.23%). The most common material used for amalgam restoration was glass ionomer cement (GIC) [n=82, 66.13%] and for PFM was composite (n=112, 90.32%). All dentists used composite for repair of defective composite restoration. (Table 3)

Statistically significant association was found between number of restorations placed and number of years of experience (p=0.001). More experienced dentists placed more restorations as compared to less experienced dentists. (Fig 2)

Dentists with more experience were doing more single tooth restoration repairs as compared to less experienced statistically (p<0.001). Among >10 years

TABLE 5: COMPARISON OF REASON AND MATERIAL FOR REPAIR OF VARIOUS DEFECTIVE RESTORATIONS BY LEVELS OF EXPERIENCE

Variable	Characteristic	<1yr, N = 18	>10yr, N = 4	1-5yr, N = 36	5-10yr, N = 22	p-value*
The reason for repair of amalgam restoration	Partial loss of restoration	5(27.78)	12(25.00)	11(30.56)	6(27.27)	0.053
	Secondary caries	2(11.11)	22(45.83)	7(19.44)	5(22.73)	
	Tooth fracture around restoration	11(61.11)	14(29.17)	18(50.00)	11(50.00)	
The reason for repair of composite restoration	Discoloration	2(11.11)	7(14.58)	8(22.22)	4(18.18)	0.091
	Partial loss of restoration	5(27.78)	12(25.00)	12(33.33)	6(27.27)	
	Secondary caries	4(22.22)	24(50.00)	9(25.00)	5(22.73)	
	Shape adjustment	1(5.56)	0(0.00)	0(0.00)	4(18.18)	
	Tooth fracture around restoration	6(33.33)	5(10.42)	7(19.44)	3(13.64)	
The reason for repair of PFM restoration	Chipping	2(11.11)	7(14.58)	8(22.22)	4(18.18)	0.091
	Partial loss of restoration	5(27.78)	12(25.00)	12(33.33)	6(27.27)	
	Secondary caries	4(22.22)	24(50.00)	9(25.00)	5(22.73)	
	Shape adjustment	1(5.56)	0(0.00)	0(0.00)	4(18.18)	
	Tooth fracture around restoration	6(33.33)	5(10.42)	7(19.44)	3(13.64)	
The material used for amalgam repair	Amalgam	0(0.00)	12(25.00)	9(25.00)	0(0.00)	0.091
	Composite	1(5.56)	11(22.92)	5(13.89)	4(18.18)	
	GIC	17(94.44)	25(52.08)	22(61.11)	18(81.82)	
The material used for composite repair	Composite	18(100.00)	48(100.00)	36(100.00)	22(100.00)	-
The material for PFM repair	Acrylic	1(5.56)	0(0.00)	2(5.56)	3(13.64)	0.054
	Composite	14(77.78)	47(97.92)	32(88.89)	19(86.36)	
	GIC	3(16.67)	1(2.08)	2(5.56)	0(0.00)	

*Fisher exact test; ** NCR, needs complete replacement

Fig 1: Number of restorations placed per week by dentists

N=124, df=c(9), φc =0.60, Fisher's p=.001
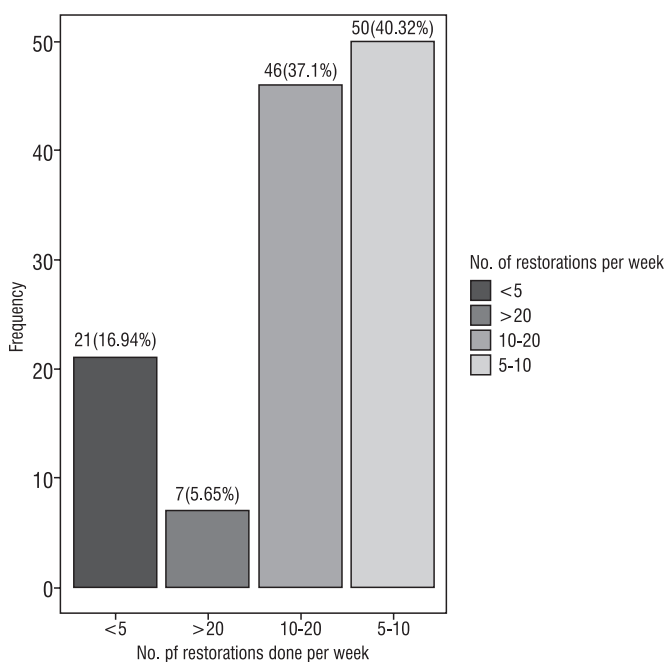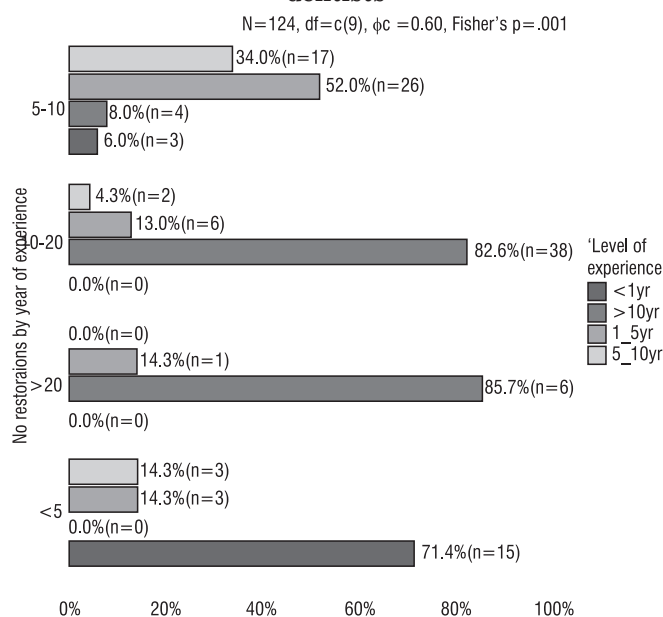
Fig 2: Number of restorations placed by dentists according to levels of experience

experienced dentists the common reason for avoiding single tooth restorations was 'previous bad experience' (n=39, 81.25%) while for <1year experienced dentists was 'lack of training' (n=12, 66.67%). These results were statistically significant (p<0.001). (Table 4)

The association of reason and material for repair of various defective restorations and level of experience was not statistically significant. (Table 5)

DISCUSSION

The study aimed to assess dentists' practices regarding the management of defective restorations. Our findings revealed that over 62% of dentists opted for repairing single defective tooth restorations. Furthermore, a majority of these dentists reported satisfactory outcomes with repaired restorations. Interestingly, our research indicated that experienced dentists tended to place more restorations compared to their less experienced counterparts. Notably, less experienced dentists often refrained from repairing restorations due to their lack of experience, while more seasoned practitioners avoided it based on previous negative experiences.

Repairing defective restorations instead of replacing them is preferred due to tooth structure conservation, minimal harm to vital pulp tissues, reduced chair-side time, lower financial burden on patients, and less need for local anesthesia injections, resulting in reduced patient apprehension and fear.[11,12] Ultimately, these factors collectively contribute to a more efficient and patient-friendly approach to dental care.

Our findings indicated that over 62% of dentists opted to repair defective restorations instead of replacing them entirely, suggesting that this practice is not widely adopted in our country. A study conducted in four Dental Hospitals of Lahore, Pakistan[14] also reached a similar conclusion by observing that only 18% of the graduates chose to repair composite restorations in their clinical practice. In contrast, a study involving 387 dentists in the US reported that 83.7% of dentists prefer repair over replacement for defective restorations.[11] Similarly, Gordan et al.[13] also noted that the majority of US and European dentists opt for repair rather than complete replacement in similar situations.

The latest study sheds light on specific challenges encountered during dental restorations. Amalgam restorations are notably vulnerable to defects resulting from fractures in the adjacent tooth structure, while composite restorations commonly develop secondary caries. Ensuring sufficient resistance form for amalgam restorations entails the removal of unsupported enamel to prevent potential compromises in restoration integrity due to fractures. In contrast, the polymerization shrinkage of composite resin leads to the formation of micro-gaps between the restoration and tooth structure, facilitating the occurrence of secondary caries. Nevertheless, advancements such as nano-hybrid and bulk-cure composites have significantly minimized the risk of secondary caries associated with composite materials.[15-17] Furthermore, although amalgam restorations may experience leakage, this inadvertent sealing of the gap between the restoration and tooth can decrease the likelihood of secondary caries.

According to our findings, the predominant material utilized for amalgam repair was GIC (n=82, 66.13%), followed by amalgam itself, while for PFM, composite (n=112, 90.32%) was the most common choice. When it comes to repairing defective composite restorations, all dentists opted for composite, finding it significantly easier to repair compared to amalgam restorations, which typically present more challenges for successful repair.[18,19]

Strengths of this study include its methodological rigor, demonstrated by the inclusion of a diverse sample comprising 124 qualified dentists from various professional backgrounds and experience levels. Furthermore, the utilization of a well-structured questionnaire featuring closed-ended questions, distributed through email and WhatsApp, enhances the reliability of the survey. However, limitations of this study include the use of convenience sampling rather than random sampling, potentially resulting in a non-representative sample. Additionally, reliance on self-reported responses may introduce bias into the findings.

CONCLUSION

Over 62% of dentists are involved in repairing defective restorations, with the reasons for repair differing between amalgam and composite restorations. Amalgam restorations typically require repair primarily because of tooth fractures, whereas composite restorations often need attention due to secondary caries. Interestingly, experienced dentists tend to avoid repairing restorations due to past negative experiences, while younger dentists are hindered by a lack of sufficient training in this area. Across the board, dentists employ a variety of materials and techniques to address defects in both amalgam and composite restorations.

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3	Hina Khan:	Critical review and drafted the final version of the manuscript
4	Taimoor Zahid:	Data collection, Data analysis, editing of manuscript
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