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Perception regarding the management of defective composite restorations in dental colleges of Pakistan: Repair versus Replacement; a Cross-sectional study

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ABSTRACT

Minimal intervention dentistry (MID) has shifted the trend towards repairing rather than replacing direct composite restorations in case already existing restoration becomes defective. Repairing these restorations has many benefits, such as preservation of tooth structure, improved prognosis, cost-effectiveness, and reduced need for local anesthesia. However, the decision-making process for managing local defects in composite restorations can be challenging for dentists. This study aimed to investigate the knowledge and practices for managing defective direct composite restorations in dental colleges in Pakistan.

A cross-sectional survey was conducted on 297 participants, which included 3rd and 4th-year dental students, house officers, and operative dentistry residents. A previously validated survey instrument was used for data collection via Google Forms.SPSS was used for the data analysis.

The results showed that most participants were taught about composite repair during their undergraduate studies. However, most participants had not repaired and replaced a defective composite restoration. The study also found a significant association between the participants' level and their preference for restoration repair vs replacement. Additionally, the study revealed that the majority of participants preferred flowable composites as their repair material, and there was a significant association between the participants' academic year and their preferred repair material for defective restoration. The most commonly used technique for finishing was with diamond finishing instruments.

The study suggests that there is a need for scientific societies and workgroups in restorative and operative dentistry to produce guidelines on key treatment steps for repairing defective composite restorations.

Keywords: *Direct composite restoration, repair, replacement, minimal intervention dentistry, teaching practices*

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INTRODUCTION

Despite advancements that have improved the durability of composite restorations, factors such as pH changes, salivary enzymes, and thermal changes can weaken their mechanical properties and lead to fractures. 1 Additionally, marginal defects, fractures, and abrasions can increase the risk of secondary caries, and discolouration may occur due to cigarettes, mouthwashes, or beverages. 2 When faced with these issues, dentists must decide whether to repair or completely replace the restoration, with minimally invasive treatment being a key principle in modern dentistry. 3

In clinical practice, the decision-making process for addressing local flaws in composite restorations can be problematic. Historically, the accepted standard of care for restorations exhibiting signs of deterioration and failure was the replacement. 4 With the advent of minimal intervention dentistry, there has been a shift towards fixing direct resin composite restorations rather of replacing them. Replacement entails introducing new restorative material without removing any dental structure, whereas repair entails removing a portion of the faulty restoration and replacing it with fresh material. Replacement, on the other hand, necessitates the total removal of the restorative material, including any areas that may appear clinically acceptable. 5, 6

There exist multiple benefits associated with repairing composite restorations that have failed, such as the conservation of tooth structure, enhancement of the prognosis, extension of the lifespan of the restoration, reduction in complexity, cost-effectiveness, and diminished probability of iatrogenic harm or recurrent stress. Moreover, this approach can decrease the necessity for local anaesthetic, thereby reducing patient anxiety and enhancing patient acceptance and collaboration..7, 8 Conversely, replacing the restoration can result in the unnecessary removal of tooth structure, weaken the tooth, cause pulpal irritation or exposure, and require more complex treatment options such as endodontic or prosthodontic measures.9

Teaching dental students about resin composite materials is a crucial part of their curriculum for restoring teeth. Various dental schools worldwide provide evidence of teaching composite repair to their students, with many employing survey questionnaires to suggest guidelines and parameters for teaching repair versus replacement. 10, 11 Despite the widespread adoption of minimally invasive dentistry, there is a lack of standardized recommendations regarding the indications and operative techniques for restoring and repairing dental restorations. Hence, there is a need for scientific societies and work groups in restorative and operative dentistry to develop guidelines on the critical treatment steps involved in repairing defective composite restorations. Such guidelines would provide clinicians with a structured approach to restorative dentistry and enable the standardization of clinical practice, thus improving patient outcomes.

It is reasonable to infer that incorporating present evidence and educational concepts related to the repair of resin composites should be incorporated into dental school programs. This study aims to explore the current educational approaches employed in addressing faulty direct composite restorations in Pakistani dental colleges and, more specifically, to evaluate the methods employed in the repair of direct composite restorations.

METHODOLOGY

Study Design: This study was a cross-sectional survey conducted between June 2022 to September 2022.

Study Participants: The study participants were 3rd- and 4th-year dentistry students studying in different dental colleges in Pakistan. Moreover, house officers and operative dentistry residents (R1, R2, R3, and R4) were also eligible.

A sample size of 320 was calculated using a formula for sample size calculation, assuming a confidence level of 95%, a margin of error of 5%, and a response distribution of 50%.

Survey Instrument: A previously used and validated survey instrument 12 was used for data

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collection. The survey instrument included questions about the study participants' Composite Restoration Repair, knowledge, attitude, and practices. The survey instrument was distributed to the participants online via Google Forms.

Data Collection: Data was collected online via Google Forms. The link to the survey was shared with the participants via WhatsApp. A snowball sampling technique was used, where the participants were asked to forward the survey link to their peers who met the study inclusion criteria. The participants were also given the option to decline participation in the study.

Data Analysis: The collected data were analyzed using appropriate statistical software like SPSS. Descriptive statistics, such as frequencies and percentages, were used to summarise the data.

Ethics Approval: The Institutional Review Board of Bolan Dental College approved the ethical aspects of the study. The participants were provided with detailed information regarding the study's objectives, confidentiality measures for their data, and their entitlement to withdraw from the study at their discretion.

RESULTS

Data of 341 participants were collected; however, data of only 297 participants were analyzed due to discrepancies. A total of 297, with 59.3% female and 40.7% male. The majority of participants were in their 3rd and final year (52.5%), followed by house officers (36.4%). Only a small percentage of participants were in R1 and R2 (5.7%) and R3 and R4 (5.4%), respectively. In terms of the province, most participants were from Punjab (40.1%), followed by Sindh (36.7%), KPK (13.8%), and Balochistan (9.4%). The mean age of the participants was 25.85, with a standard deviation of 5.806.

TABLE 1: Demographics of the study participants

Variable	Frequency	Percent
Gender		
Female	176	59.3
Male	121	40.7
Level		
3rd and Final Year	156	52.5
House Officers	108	36.4
R1 and R2	17	5.7
R3 and R4	16	5.4
Province		
Punjab	119	40.1
Sindh	109	36.7
KPK	41	13.8
Balochistan	28	9.4
Mean Age	25.85	5.806

Table 2 provides the frequencies of responses from different groups of dental professionals to a questionnaire about composite restoration repair and replacement. The groups include 3rd and final-year dental students, house officers, R1 and R2 (first and second-year residents), and R3 and R4 (third and fourth-year residents).

For the question, "Have you been taught about indications and techniques of composite repair during Bachelor of Dental Surgery?", most participants responded with "Yes." Specifically, out of 297 participants who responded to this question 203 were from the "Yes" group and 94 were from the "No" group. However, there was no significant difference in the responses among the groups as indicated by the chi-square test ($X2=4.276$, $P=0.233$).

For the question, "Repair is least time-consuming than a replacement", the majority of participants

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responded with "Yes." And the difference among the groups was insignificant (X2=5.15, P=0.161).

For the question, "During decision-making to repair defective composite restorations, patients' preference should be considered", the majority of participants (n=262) responded with "Yes." And the difference was insignificant (X2=2.90, P=0.40).

TABLE 2: Knowledge of the participants towards composite restoration's repair vs replacement

Question		Total	3rd and Final Year	House Officers	R1 and R2	R3 and R4	X2 , P
Have you been taught about indications and techniques of composite repair during Bachelor of Dental Surgery?	NO	94	48	40	3	3	4.276, P=0.233
	YES	203	108	68	14	13	
Repair is least time-consuming than replacement	No	59	36	20	3	0	5.15, P= 0.161
	Yes	238	120	88	14	16	
During decision-making to repair defective composite restorations, patients' preferences should be Considered	No	35	20	12	3	0	2.90, P= 0.40
	Yes	262	136	96	14	16	

The study investigated the association between participants' level (3rd and Final Year, House Officers, R1 and R2, R3, and R4) and their preference for restoration repair vs replacement in different clinical scenarios. In the case of small surface defects, most participants opted repair as a treatment choice. Moreover, participants approved repair as an optimal option for faulty composite restorations with a risk of pulpal damage. However, in the case of secondary caries, participants favored replacement as an ideal solution. As for longevity and choice of permanent restoration, most participants opted for replacement of composite restoration rather than repair. (Table 3)

TABLE 3: Participant's choice of treatment to manage defective composite restoration in different clinical situations/scenarios

Question		3rd and Final Year	House Officers	R1 and R2	R3 and R4	X2 , P
Treatment choice in a small surface defect of a composite restoration	Repair	120	68	14	14	9.13, P=0 .028
	Replacement	36	40	3	2	
The presence of secondary caries in a previously restored tooth with composite is an indication of	Repair	48	16	0	6	16.05, P<0.001
	Replacement	108	92	17	10	
Risk of pulpal damage in a defective Composite restoration can be avoided by	Repair	76	76	8	12	15.02, P=0.002
	Replacement	80	32	9	4	
Which one is a more invasive and destructive treatment option	Repair	60	24	3	0	16.68, P<0.001
	Replacement	96	84	14	16	
Increased longevity of a defective restoration is expected to be in case of	Repair	56	44	0	10	15.17, P=0.002
	Replacement	100	64	17	6	
Which one is considered a permanent filling	Repair	48	8	9	0	34.51, P<0.001
	Replacement	108	100	8	16	

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The results suggest a significant association between the participants' level and their perception of the most common indication that needs repair of the composite. Specifically, the majority of the 3rd and Final Year participants identified partial loss of composite (n=72), followed by Secondary caries as a primary indication for repair rather than a replacement (n=36). The association between the participants' level and their perception was significant (X2 = 31.50, P < 0.001).

Similarly, there is also a significant association between the participants' level and their perception of the most common indications that dictate replacement rather than repair of the composite. The majority of the 3rd and Final Year participants identified secondary caries (n=92), followed by Fracture of restoration (n=36). However, the association between the participants' level and their perception was not statistically significant (X2 = 21.27, P = 0.11). Table 4

TABLE 4: Participants choice regarding the indication of repair and replacement of the composite

Question		3rd and Final Year	House Officers	R1 and R2	R3 and R4	X2 , P
What is the most common situation that needs repair	Discolor of the restoration	20	24	3	1	31.50, <0.001
	Fracture of restoration	28	8	0	7	
	Partial loss of composite	72	52	14	4	
	Secondary caries	36	24	0	4	
What is the most common situation that needs replacement	Discolor of the restoration	12	12	0	0	21.27, P=0.11
	Fracture of restoration	36	32	0	5	
	Partial loss of composite	16	4	0	0	
	Secondary caries	92	60	17	11	

The preferred finishing technique for composite repair for most 3rd and Final year participants is by using a diamond finishing instrument (n=56). House officers and residents preferred finishing discs. The difference among the group is significant (X=107.37, P<0.001). The association between the participants' academic year and their preference for repair material was significant (X2 = 23.06, P = 0.027). A significant difference among the different group have been reported for the question "Have you placed a defective composite restoration?" (X2=66.95, P<0.001). The majority of the 3rd year and final-year students said , 'NO'. All of the R-3 and R-4 participants mentioned 'Yes'. Moreover, flowable composite is the choice of treatment for repair of defective restoration by most participants. (X2=23.06, P=0.027)

For the question, "Have you repaired the composite restoration?", a significant difference was evaluated (X2=41.85, P<0.001).Table 5

TABLE 5: Practice and Attitude of Participants of different academic years towards replacement and repair.

Question		3rd and Final Year	House Officers	R1 and R2	R3 and R4	X2 , P
What is your preferred finishing technique for composite repair?	Finishing burs, points, polishing paste	0	4	0	0	107.37, P<0.001
	Finishing discs	8	44	8	7	
	No idea	12	0	0	0	
	Polishing paste	20	4	0	0	
	Polishing points	32	4	0	7	

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	Tungsten carbide finishing instruments	28	8	3	0	
	Use of diamond finishing instruments	56	44	6	2	
What type of surface treatment you prefer for defective resin Composites	Air abrasion with Al2O2	16	4	3		38.96, P=0.010
	Application of 37% Phosphoric acid etching	56	52	6	9	
	No idea	12	0	0	0	
	No surface treatment	16	20	3	0	
	Roughening with a diamond bur	36	28	5	7	
	Sand blasting	20	4	0	0	
What type of Repair material you prefer for a defective restoration	Flowable Composites	64	44	11	4	23.06, P=0.027
	Micro hybrid Composite	48	24	3	9	
	Nano Hybrid Composite	36	40	3	3	
	No idea	8	0	0	0	
Have you been replaced a defective composite restoration	No	92	16	3	0	66.95, P<0.001
	Yes	64	92	14	16	
Have you repaired the composite restoration	No	100	36	11	0	41.85, P<0.001
	Yes	56	72	6	16	

DISCUSSION

The present study explored the teaching methodologies employed in undergraduate dental colleges in Pakistan regarding managing defective direct composite restorations and the corresponding repair techniques. Results revealed that most dental colleges in Pakistan incorporated teachings on composite repair, and the participants exhibited a sound understanding of the indications and techniques associated with composite restoration repair. Restoration repair procedures are incorporated into the curriculum of the vast majority of dental schools in Japan (95%), 13 the United States and Canada (88%) 14 and the United Kingdom and Ireland (88%) 15. Patients must know that a repaired restoration is not a complete replacement and may be prone to early failure. Therefore, patients must be educated regarding the limitations of restoration repair procedures to ensure that they have realistic expectations of the outcomes.16

However, in the current study, most participants reported that they never replaced or repaired a defective composite restoration. The results are consistent with the previous studies. 17, 18

Fareed et al in their study, reported that two third dental colleges in Pakistan employed combination of both clinical and didactic learning regarding composite repair as compared to one-third of dental colleges where only didactic teaching of composite repair was reported 17.

The results showed that most participants preferred restoration repair over replacement in small surface defects of composite restorations. Several clinicians have opted for resin-based composite material to either repair or replace failed restorations, as highlighted by various studies .19, 20 Owing to their bonding properties, these materials can be applied to small areas, offering a viable option for repairing defective restorations. According to several studies, the bond strength of repaired restorations using resin

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composite materials has been deemed acceptable.21 Furthermore, clinical evaluations have shown that the long-term success rates of these restorations are also satisfactory. 22, 23

Most participants preferred to consider the patient's preference during decision-making for composite restoration repair. The findings of this study align with a similar investigation, which reported that 41% of clinicians endorsed engaging patients in the decision-making process for repairing or completely replacing composite restorations. This indicates a consensus among healthcare providers regarding the importance of involving patients in decisions related to their dental care. These findings align with the principles of minimally invasive dentistry, which emphasizes preserving tooth structure and avoiding unnecessary removal of sound tissue.24

Kanzow et al. performed a research study examining the teaching of restoration repair in German dental schools. The study revealed that the primary objectives for educating students on restoration repair were maintaining tooth structure (97%) and decreasing damage to the dental pulp (79%). These findings underscore the importance of restoration repair education in dental schools and highlight the benefits of this approach in promoting dental health.25 A retrospective analysis of composite restorations repair versus replacement also showed that composite restorations have a higher survival rate, with repaired restorations last as long as replacement restorations.26

The study also found a significant association between the participants' academic year and their preference for finishing technique and use of repair materials.27 A survey conducted in Japan revealed that out of 18 schools, 16 reported flowable composite as the preferred material for completing repairs.14 In contrast, our study found that 45.3% of participants preferred using both flowable and conventional composite for repairs. Notably, most third- and final-year participants in our study favoured using flowable composites and nano-hybrid composites for repairs.

The results of the present study depicted/showed that the majority of the participants (n=123, 41%) used 37% phosphoric acid gel as a surface treatment prior to composite placement as a repair material. The findings are consistent with the previous study, where 43.3% of the clinicians opted for chemical treatment prior to restoration repair 28.

However, the most commonly taught/recommended surface treatment by the numerous dental colleges in Canada, USA, UK and Ireland is to roughen the restoration mechanically 14. However, 78% of Japanese dental schools believe that mechanical roughening of surface has no additional benefit on the success of composite repair 13.

The survey findings indicate that most dental students in Pakistan have received instruction on the indications and techniques for composite repair as part of their Bachelor of Dental Surgery program. However, fewer participants reported having clinically replaced or repaired defective composite restorations. This may indicate a need for more practical training on composite restoration repair techniques. These findings are in accordance with the findings of the previous studies. 17, 29

Prior research has suggested that replacing a previously filled composite restoration can be lengthy, potentially harming the dental pulp due to unnecessary destruction of tooth structure and decreasing resistance to fractures. The results of this study suggest that the likelihood of pulpal damage occurring during the repair of a faulty composite restoration can be notably decreased ($P<0.001$). 30

CONCLUSION

The study suggests that composite restoration repair is being taught in Pakistan's undergraduate and postgraduate dental colleges, and most participants know the indications and techniques of composite repair. However, dental students need to increase their practical experience of composite restoration repair to align with the principles of minimally invasive dentistry. Dental schools should consider incorporating guidelines for composite restoration repair in their curricula to enhance the clinical skills of their students. Future studies could investigate

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the clinical skills of dental students in composite restoration repair and assess the long-term outcomes of composite restoration repair compared to replacement.

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