

## **Assessment of Knowledge and Awareness on Cementation Protocols for Fixed Partial Dentures Among Dental undergraduate, House Officers and Postgraduates in Dental Colleges of Dow University of Health Sciences, Karachi, Pakistan**

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**Abstract:** According to previous researches documented, only 19.33% of postgraduates knew all protocols used during cementation, whereas the majority of undergraduates did not. Therefore, this survey was conducted with the aim to investigate the Knowledge and Awareness on Cementation Protocols for Fixed Partial Dentures among Dental undergraduate, House Officers and Postgraduates. The self-administered questionnaire was distributed among two sixty participants among different colleges of Dow University of Health Sciences, Karachi. The results of study revealed that 6.5% of postgraduates were aware of all cementation protocols followed by house officers (5%) and final year (4.6%). The most common reason for failure was periodontal diseases (40.3%) anticipated by postgraduates followed by secondary caries (34.6%). House officers 13.4% periodontal diseases, 12.3% whereas final year 18.4% considered periodontal diseases and 12.6% secondary caries as main reasons for failure.

**Key Words:** Assessment, Cementation Protocols, Fixed Partial Denture.

### **1. INTRODUCTION:**

Edentulism is the condition of not having any natural teeth<sup>1</sup>. It affects not only oral function but also leads to deterioration of systemic health and quality of life.<sup>2-3</sup> One or more teeth, but not all, are absent in a partly dentate patient<sup>4</sup>. Usually, a fixed (implant or tooth-supported) or removable prostheses are used to replace the missing teeth. The use of dental prostheses slows the deterioration caused by tooth loss. Although removable prosthesis can improve the aesthetics, mandibular stability, ability of mastication, and speech. Patients still have to face the sense of disability, early aging, and limited functional abilities. Fixed dental prosthesis or FDP can greatly diminish the adaptation process.<sup>5-6</sup> FDP transfers masticatory forces to the remaining teeth in the bone in such a way that its masticatory action is almost equal to the masticatory action of natural teeth.<sup>5</sup> Therefore, FDP is physiologically more favorable. Different studies to determine patient satisfaction took place in different countries such as Sweden, Finland, the Netherlands, Croatia, and Singapore have shown that patients' satisfaction with FDP was very high.<sup>7-13</sup>

Proper luting agent selection and cementation process are two elements that influence the lifespan of FDP.<sup>14-15</sup> so it's important for a dental practitioner to know the properties of luting agents and to follow all the clinical cementation guidelines such as isolation, retentive properties, suitable luting cement, and proper try-in to ensure longevity of the treatment. Failure to follow the guidelines can cause marginal discrepancy, micro-leakage, post-cementation sensitivity, secondary caries, pulpitis, and periodontal disease that ultimately leads to failure of the restoration.<sup>16-19</sup> 19.33% of postgraduates knew all protocols used during cementation, whereas the majority of undergraduates did not according to several studies documented.<sup>20</sup> With the help of this study, we can assess and enhance the previous knowledge regarding cementation techniques and protocols of dental students so that there would be less chance of post cementation complications and failure of FDP as students will follow the protocols.

## **2. METHODOLOGY**

The survey Instrument was a self-administered anonymous questionnaire in the English language. The study included a convenience sample of students of Final year BDS, House Surgeons and Dental Postgraduates of DDC, DIDC and DIKIOHS, Dow University of Health Sciences, Karachi.

### **2.1 Survey Tool**

A self-administered anonymous questionnaire was formulated in English language. In this research, students of Final year BDS, House officers and Dental Postgraduates of DDC, DIDC and DIKIOHS, Dow University of Health Sciences, Karachi was included. This study had commenced after approval from Institutional Review Board. The purpose of the research was elucidated to the students, and they provided their signed consent. The participation took place voluntary and confidentiality of participants was maintained. Survey forms were developed from a previous investigation and changes were made keeping the local context in mind<sup>21</sup>.

Questions regarding the assessment of knowledge and understanding on cementation protocols of FDP were asked from dental undergraduates, postgraduates and house officers. All the questions were asked anonymously. The questionnaire comprises of 20 multi choice questions and was divided into two parts. Part 1 included five questions on the respondents' socio-demographic and contact information, such as their name, age, gender, educational level, and email address. Part 2 contained 15 questions about dental undergrads, house officers, and postgraduates' knowledge and Awareness of Cementation Protocols for FDPs. A total of 260 questionnaires were sent to participants who met the inclusion criteria online via Google Forms, Twitter, email, and WhatsApp groups. The Google Form was only accessible for a fortnight and was then repeated.

## **2.2 Study Design, Setting & Duration:**

The study design was cross-sectional and steered among dental students of Dental colleges of Dow University of Health Sciences, which included Dow Dental College (DDC), Dr. Ishrat Ul Ibad khan institute of Oral Health Sciences (DIKIOHS), Dow International Dental College (DIDC), Karachi, from December -2023 to March-2024.

## **2.3 Ethical Approval:**

Ethical approval was issued by Institutional Review Board (IRB) of Dow University of Health Sciences, IRB No: Ref: IRB-2855/DUHS/Approval/2023/433, Following an explanation of the study's objectives, selected participants were invited to participate willingly. Participants provided informed written consent before being a part of this research, the responses obtained were kept confidential.

## **2.4 Population and sampling**

Two hundred sixty (260) participants by using this formula  $n = [DEFF*Np(1-p)] / [(d^2/Z^2_{1-\alpha/2}*(N-1) + p*(1-p)]$  and selected randomly who met inclusion criteria for the research duration were observed. The participants were carefully chosen using Non probability consecutive sampling technique.

Total sample size was Two hundred sixty (260) participants calculated by using Open EPI online software by using this formula  $n = [DEFF*Np(1-p)] / [(d^2/Z^2_{1-\alpha/2}*(N-1) + p*(1-p)]$ .

Dental undergraduates (Students of Final year BDS), postgraduates and house surgeons of DDC, DIDC and DIKIOHS, Dow University of Health Sciences, Karachi. Age ranges from 22 to 40 years and both gender (male &female) was included, while those who were not willing to participate in the study and Incomplete filled questionnaire were excluded.

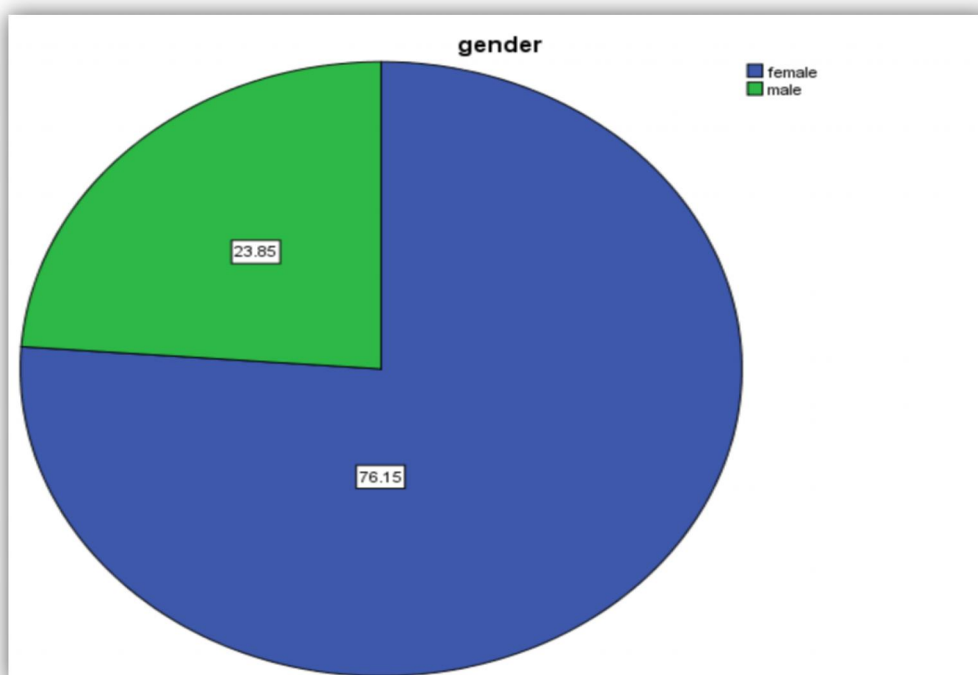
## **2.5 Statistical Analysis**

Version 23.0 of the SPSS software was used to conduct the statistical analysis. The gender and educational level were described using frequency and percentages. The students' degree of knowledge is represented by descriptive indices like percentages. The student's

perceptions of the cementation process were evaluated using an independent chi square test. A P value of 0.05 or less was considered significant.

### 3. RESULTS

Cement properties employed to cement restorations provides intimate contact between the surfaces of prepared teeth and restorations therefore they have to be especially addressed. The dentist must have a thorough awareness of the benefits and drawbacks of each type of cement. The study found that 6.5% of postgraduates were aware of all cementation protocols followed by house officers (5%) and final year (4.6%). The majority of postgraduates (17.3%) considered retentive properties to be a major protocol to be followed during cementation while the house officers (13.5%) and final year (17.3%) chose isolation. Suitable cement selection was preferred by 14.2% of the participants (postgraduates- 3.7%; house officers – 5.3%; final year – 5.7%). Proper try in was least considered factor selected by postgraduates (1.1%), house officers (2.6%) and final year (1.9%). This suggests that postgraduates were more knowledgeable about cementation protocols than house officers and final year, although there was no statistically significant difference amongst all participants. (P value = 0.060 (>0.05))



**Figure: 1 – Frequency of Participant's Gender**

Institute		Frequency	Percentage %
	DIKIOHS	160	61.5%
	DDC	50	19.2%
	DIDC	50	19.2%
	Total	260	100.0%

**Table: 1- Frequency of participants in different colleges.**

The survey investigated significant correlation between the degree of study and the isolation methods utilized. Specifically, 9.6% of postgraduate students knew that cotton rolls were primarily used as an isolation method during cementation whereas 15.3% house officers and 15% final year thought of rubber dam as a method of isolation followed by air way syringe (postgraduates – 5%; house officers 12.6%; final year 10.7%). No statistically significant difference was observed P value = 0.369 (<0.05).

This survey also concluded that 76.1% of all participants believed in advising patients about maintaining prosthesis (postgraduates- 18.7%; house officers – 30.7%; final year – 27%) while 23.8% assumed that it was not necessary out of which majority of participants were final year 11.1%.

Regarding the reasons for the failure of cementation of the prosthesis, postgraduates assumed inadequate isolation (6.5%) followed by undercuts (6.1%) to be the main reason for failure where as 11.5% house officers and 11.9% final year believed irregularities between two materials were the cause along with voids present in the restoration-tooth interface (final year 11.9%), there was no statistically significant difference P value = 0.163 (>0.05).

The life span of prosthesis was observed to be 2.5-5 years by majority of postgraduates (10%), house officers (15%) and final year (13%) where as 39% of house officers assumed that there will be life time span.

The most common reason for failure was periodontal diseases (40.3%) anticipated by postgraduates followed by secondary caries (34.6%). House officers documented 13.4% periodontal diseases, 12.3% whereas final year 18.4% considered periodontal diseases and 12.6% secondary caries as main reasons for failure. Although there was no statistically significant difference P value = 0.196 (>0.05) but there was strong correlation amongst levels of study with regard to periodontal disease and secondary caries predicted as noteworthy causes of failure.

Regarding the correlation between the level of study and the cause for replacing the FPD, it was observed that 10.67% of postgraduate students and 40% of undergraduate students were

equally aware that the replacement of the FPD was primarily due to a fractured crown. However, this correlation was not statistically significant.

Questions	Level.of.study			Total	p value	
	final year	house officer	post graduate			
Q1. What protocols do you follow for the cementation of dental prostheses	Isolation	45 (17.3%)	35(13.4%)	13(5%)	93(35.7%)	.060
	Retentive properties	23 (8.8%)	31 (11.9%)	19(17.3%)	73 (28.07%)	
	Suitable cement selection	15 (5.7%)	14 (5.3%)	8 (3.07%)	37 (14.2%)	
	Proper try in	5 (1.9%)	7(2.6%)	3(1.1%)	15(5.7%)	
	All of the above	12 (4.6%)	13 (5%)	17 (6.5%)	42 (16.1%)	
Total	100 (38.4%)	100 (38.4%)	60(23.07%)	260(100%)		
Q2. What isolation methods do you follow for the cementation of dental prostheses?	Cotton roll	33(12.6%)	27 (10.3%)	25 (9.6%)	85(32.6%)	.369
	rubberdam	39 (15%)	40(15.3%)	22(8.4%)	101(38.8%)	
	air-way-syringe	28(10.7%)	33(12.6%)	13(5%)	74(28.4%)	
Total	100(38.4%)	100(38.4%)	60(23.07%)	260(100%)		
Q3. Do you advise the patients on how to maintain the prostheses?	yes	71 (27%)	80(30.7%)	47(18.07%)	198(76.1%)	.296
	no	29 (11.1%)	20 (7.65)	13 (5%)	62(23.8%)	
Total	100 (38.4%)	100 (38.4%)	60(23.07%)	260(100%)		
Q4. What is the reason for the failure of cementation of the prosthesis?		31(11.9%)	18(6.9%)	13(5%)	62(23.8%)	.163
	undercuts	21(8%)	26(10%)	16(6.1%)	63(24%)	
	Irregularities between two materials	31(11.9%)	26(10%)	14(5.35)	71(27.3%)	
	Inadequate isolation	17(6.5%)	30(11.5%)	17(6.5%)	64(24.6%)	
Total	100(38.4%)	100(38.4%)	60(23.07%)	260(100%)		
Q5. What do you think is the life span of the prosthesis after cementation?	> 5 years	34(13%)	22(8.4%)	16(6.1%)	72(27.6%)	.325
	2.5-5 years	34(13%)	39(15%)	26(10%)	99(38%)	
	life time	32(12.3%)	39(15%)	18(6.9%)	89(34.2%)	
Total	100(38.4%)	100(38.4%)	60(23.7%)	260(100%)		

Q6. What is the most common reason for the failure of dental prostheses?	Periodontal disease	48(18.4%)	35(13.4%)	22(8.4%)	105(40.3%)	.196
	secondary caries	33(12.6%)	32(12.3%)	25(9.6%)	90(34.6%)	
	Fracture of crown	8(3%)	17(6.5%)	5(1.9%)	30(11.5%)	
	lack of retention	11(4.2%)	16(6.1%)	8(3.07%)	35(13.46%)	
Total		100(38.4%)	100(38.4%)	60(23.07%)	260(100%)	

**Table: 2 – Participant’s Awareness Regarding Cementation Protocol**

Questions	Level of study				Total Bioanalysis Impact Factor: 1.8 (2024)	P- Value
	Final year	House Officers	Postgraduate			
Bioanalysis ISSN:1757-6199 VOLUME 16, ISSUE 6 page 273-287 Journal link: <a href="https://bioanalysisjournal.com/">https://bioanalysisjournal.com/</a> Abstract Link: <a href="https://bioanalysisjournal.com/abstract-273-287">https://bioanalysisjournal.com/abstract-273-287</a> 20 MAY 2024						
Q 1. The selection of a luting agent is based on		Final year	House Officers	Postgraduate		.004
	Its properties	61(23.4%)	52(20%)	18(7%)	131(50.4%)	
	Clinical preference	15(5.7%)	23(9%)	15(5.7%)	53(20.4%)	
	The type of restoration to be luted	5(1.9%)	11(4.3%)	11(4.3 %)	27(10.5%)	
	All of the above	19(7.3%)	14(5.3%)	16(6.1%)	49(18.7%)	
	Total	100(38.5%)	100(38.5%)	60(23%)	260 (100%)	
Q2. Zinc phosphate	the benchmark for a luting agent	47(18.7%)	36 (13.8%)	16(6.2%0	99(38.7%)	.092
	Sets by an exothermic, acid-based setting reaction	29(11.1%)	40(15.38%)	20(7.69 %)	89 (34.2%)	
	suitable for cast posts and cores as well as metal/PFM single units and 3-unit bridges ( )	14(5.3%)	14(5.3%)	16 (6.1 %)	44(16.9%)	
	all of above	10(3.8%)	10 (3.8 %)	8 (3.07%)	28(10.7%)	
	Total	100(38.4%)	100 (38.4 %)	60 (23 %)	260 (100%)	
Q3, When using zinc phosphate, mixing the powder and liquid causes an exothermic reaction; hence	mixed very slowly	54 (20.7%)	43 (16.5 %)	19 (7.3 %)	116(44.6%)	.073
	placed patient's mouth with extreme caution to prevent a physical burn	24 (9.2 %)	34 (13.07 %)	19 (7.3 %)	77 (29.6%)	
	a glass slab is used to absorb the heat from the process	11 (4.2 %)	13 (5 %)	15 (5.7 %)	39 (15 %)	
	. it is not useful for a restoration that contains impurities	11 (4.2 %)	10 (3.8 %)	7 (2.6 %)	28 (10.7%)	
	Total	100 (38.4 %)	100 (38.4 %)	60 (23 %)	260 (100 %)	
Q4. The use of light-cured resin cements should be limited to restorations where the	1mm	39 (15%)	33 (12.6 %)	20 (7.6 %)	92 (35.3 %)	.364
	2mm	41 (15.7 %)	51 (19.6 %)	22 (8.4 %)	114 (43.8 %)	
	3mm	12 (4,6 %)	8 (3 %)	10 (3.8 %)	30 (11.5 %)	
	4mm	8 (3 %)	8 (3%)	8 (3%)	24 (9.2 %)	
	Total	100 (38.4 %)	100 (38.4 %)	60 (23 %)	260 (100 %)	



thickness of the restoration does not exceed:						
Total		100 (38.4 %)	100 (38.4 %)	60 (23 %)	260 (100%)	
Q5. All metal, composite, and oxide ceramics should be treated with	1. pure silane	23 (8.8%)	17 (6.5 %)	8 (3 %)	48 (18.4 %)	
	methacryloyloxydecyl dihydrogen phosphate (MDP	31 (11.9 %)	34 (13.7 %)	19 (7.3%)	84 (32.3 %)	
	. containing metal/zirconia primer	22 (8.4 %)	22 (8.4 %)	12 (4.6%)	56 (21 %)	.856
	. 10% phosphoric acid	14 (5.3 %)	16 (6.1 %)	12 (4.6 %)	42 (16.1 %)	
	30% carbamide peroxide	10 (3.8 %)	11 (4.2 %)	9 (3.5%)	30 (11.5 %)	
Total		100 (38.4%)	100 (38.4 %)	60 (23%)	260 (100 %)	
Q6. RMGIs combine some properties of glass-ionomer (its fluoride release and chemical adhesion) with what properties of resins?	. high strength and high solubility	30 (11.5%)	18 (6.9 %)	10 (3.8 %)	58 (22.3 %)	
	high strength and low solubility	39 (15%)	44 (16.9 %)	24 (9.2 %)	107 (41.1%)	
	low strength and high solubility	20 (7.6 %)	25 (9.6 %)	17 (6.5 %)	62 (23.8 %)	
	. low strength and low solubility	11 (4.2 %)	13 (5%)	9 (3.4 %)	33 (12.6%)	.387
Total		100 (38.4 %)	100 (38.4 %)	60 (23 %)	260 (100 %)	
Q7. . The setting reaction for GICs	Involves the interaction of polyacrylic acid with fluoroaluminosilicate particles	25 (9.6 %)	22( 8.46 %)	15 (5.7 %)	62 (23.8 %)	.991
	Results in polymerization	28 (10.7 %)	31(11.9 %)	15 (5.7 %)	74 (28.46%)	
	Involves cross-linking between the	25(9.6 %)	25 (9.6%)	14 (5.38 %)	64 (24.6 %)	

	polyacrylic acid					
	Metal ions in the GIC	6 (2.30 %)	8 (3.07 %)	5 (1.09 %)	19 (7.3 %)	
	1 & 3	16 (6.16 %)	14 (5.3 %)	11 (4.2 %)	41 (15.3 %)	
Total		100 (38.4 %)	101 (38.4 %)	60 (23 %)	260 (100 %)	
Q8. Self-adhesion and moisture tolerance are advantages of	etch-and-rinse composite resins	29 (11.1 %)	21 (8.07 %)	9 (3.4 %)	59 (22.69 %)	.524
	GICs and RMGICs	42 (16.1%)	45 (17.3 %)	28 (10.7 %)	115 (44.2 %)	
	zinc polycarboxylate	17 (6.5 %)	22 (8.46 %)	13 (5%)	52 (19.8 %)	
	zinc phosphate	12 (4.6 %)	12 (4.6 %)	10 (3.8 %)	34 (13 %)	
Total		100 (38.4 %)	100 (38.4 %)	60 (23.07 %)	260 (100 %)	
Q9. Post-Operative sensitivity is most frequently associated with the use of luting agent	GIC	37 (14.2 %)	24 (9.2 %)	9 (3.46 %)	70 (26.9 %)	.083
	Calcium aluminate/GIC	42 (14.4%)	47 (18.07 %)	30 (11.5 %)	119 (45.7 %)	
	Composite resin	16 (6.1 %)	20 (7.6 %)	14 (5.3 %)	50 (19.2 %)	
	RMGIC	5 (1.9 %)	9 (3.46 %)	7 (2.6 %)	21 (8.07 %)	
Total		100 (38.4%)	101 (38.4%)	60 (23 %)	260 (100%)	

**Table: 3 – Participant’s Knowledge Regarding Cementation Protocol**

#### 4. DISCUSSION

For a dental treatment to be successful, dentistry is an art and science that should work together. A dental restoration's clinical efficacy is dictated by displaying its correlation between the study level and the knowledge about the cementation protocols. The survey revealed that all the postgraduates, house officers and final year students had knowledge and awareness about cementation protocols with retentive factor being most familiar among postgraduates (17.3%), and isolation was important parameter for house officers (13.5%) and final year (17.3%). there was no statistically significant difference amongst all participants. (P value = 0.060 (>0.05))

During prosthetic cementation, postgraduates 9.6% used cotton rollers for isolation whereas 15.3% house officers and 15% final year thought of rubber dam as a method of isolation followed by air way syringe. According to Raigrodski et al. (2012)<sup>23</sup>, proper isolation using

cotton rolls, suction tip, and airway syringe during cementation of fixed dental prostheses leads to increased longevity compared to non-isolated prostheses. However, this ran counter to a study by Mitchell et al. (2009)<sup>24</sup>, which found that undergraduate students were unaware that isolation plays a significant role in a permanent dental prosthesis's lifespan.

76.1% of all participants believed in advising patients about maintaining prosthesis while 23.8% assumed that it was not necessary out of which majority of participants were final year 11.1%<sup>22</sup>. These students need to be informed about instructing patients regarding the methods because the likely causes of this could be lack of understanding of the necessary protocols.

The clinical outcome of a dental restoration depends on relationship between the reason for FPD failure and the study level. 6.5% of postgraduates assumed that inadequate isolation, 11.5% house officers and 11.9% final year believed irregularities between two materials was a major cause of FPD failure after cementation, with statistical insignificant difference [P value = 0.163 (>0.05)]. This was consistent with a study by Keerthana et al (Keerthana, Dhanraj<sup>25</sup>, and Jain, 2018), which found that the majority of dental students were aware of the methods used during the cementation of fixed partial dentures. The luting agent for fixed dental prostheses with crucial abutments is considered critical because it has a significant impact on post-cementation sensitivity and final prosthesis success. As a result, it is critical that trainees understand all of the components required for effective cementation of fixed dental prostheses.

Both undergraduates and postgraduates were aware about most common causes for failure of fixed prosthesis where majority of postgraduates, house officers and final year students anticipated periodontal disease (40.3%) followed by secondary caries (34.6%) and lack of retention (13.46%) to be most contributing factors. Secondary caries is caused by a lack of luting cement during prosthesis cementation, leading to marginal leakage and a higher risk of developing secondary caries. This was indicated in the study of Song et al. (2013)<sup>26</sup>. Moreover, improper cementation can lead to fractures and dislodged crowns. Proper cementation protocols are crucial for prosthodontic success in the final stage. Students ought to be educated about this.

In terms of fixed partial denture failure, both undergraduates and postgraduates were aware of the causes, such as inadequate isolation, voids between the restoration and tooth interface, and undercuts. This was consistent with the findings of Scurria et al.'s study (Scurria, Bader, and Shugars, 1998)<sup>27</sup>, in which he claimed that insufficient isolation causes saliva to contaminate the prosthesis during cementation, weakening bond between the prosthesis and the tooth. Inadequate cement and voids between restoration-tooth contacts can cause poor bonding and shorten the longevity of the prosthesis. Postgraduates were more aware of this. According to the study of Miettinen et al. (Miettinen and Millar, 2013)<sup>28</sup>, this was the case. To obtain a good treatment outcome, it's critical to use improved isolation procedures, choose the right luting cement, and seal the area uniformly.

50.4% of respondents assumed that selection of luting agent is based on its properties, out of which majority were final year (23.4%). 20.4% postgraduates assumed that clinical preference was the reason for selection of a luting cements. Further analyzing the knowledge about cements, 18.7% final year thought zinc phosphate as a benchmark for luting agents,

while 7.69% postgraduates and 15.38% house officers had knowledge that it sets by an exothermic, acid-based setting reaction. 2.3% participants assumed that all metal, composite, and oxide ceramics should be treated with. MDP<sup>22,26</sup>.

41.1% respondents (Postgraduates 9.2%, House-officers 16.9%, final year 15%) assumed that RMGIs combine some properties of glass-ionomer with high strength and low solubility properties of resins. Self-adhesion and moisture tolerance are advantages of GICs and RMGICs according to the (44.2 %) of participants, 17.3% house officers, 16.1 % final year, 10.7% postgraduates.

45.7% respondents believed that post-operative sensitivity was associated with calcium aluminate followed by GIC 26.9% and composite 19.2%. of these majority postgraduates 11.5% and 18.7% assumed that calcium aluminate caused most post-operative sensitivity followed by 14.2% final year considering GIC to be the reason of the same<sup>26</sup>.

**Conclusion:** It can be seen, within the limits of this study, that dental students, undergraduate, graduate and postgraduates, possess an adequate awareness of the cementation protocols for FPD. Postgraduates knew more about FPD's cementation procedures. Both postgraduates and undergraduates knew the same reasons why FPD failed and why it was replaced but several instructional webinars, conferences, scientific talks, and panel discussions are needful that can be held to increase students' knowledge.

### Data Availability

The corresponding author can provide the data used to support the study's findings upon request.

### Conflicts of Interest

The authors declare no conflict of interest.

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