Composites Used for Different Restorations Among the Postgraduate Dental Students and Practitioners - A Survey

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Abstract: Composite resins are a class of advanced and very well prevailing conventional restorative material. They can be used in both anterior and posterior restorations. Composites have their own indications and allusion in anterior and posterior teeth for restoration. The choices of aspired dental composite keeps changing along with the evolution of dental composites, for example, the development of smaller particle size, improved bonding system, curing refinements and sealing systems. This article solely focuses on identifying the most preferred composite material for anterior and posterior restorations. The aim of this study is to conduct a survey among many PG dental students and PG graduated dental practitioners from Chennai and then to analyse their choices and preferences in using different composite materials for anterior and posterior restorations in restorative dental therapy. A total number of 109 PG dental students and PG graduated dental practitioners took part in this survey. A questionnaire containing 15 questions was distributed through an online platform called Google Forms. The results were then collected and statistically analysed through SPSS software. Among the total participants who attended this survey, 55.96% were PG dental students and the remaining 44.04% were dental PG graduated dental practitioners from Chennai. Most of them preferred hybrid composite for anterior restoration. Majority of them seemed to think amalgam restorations to be easier for posterior restoration. A comparison between dentists with various qualifications on different light activation methods, preferences on composite materials for restoration, easily usable restorative materials and preferences of composite materials for posterior restoration was done (Chi-square analysis). It was found that there is no statistically significant difference (p-value >0.05) between the postgraduate students and dental practitioners on the composite preferences and its usage. From this survey it's evident that PG dental students and PG graduated dental practitioners prefer hybrid composite for anterior restoration and find amalgam restoration to be preferred for posterior restorations.

Keywords: Composite restoration ; anterior restoration ; posterior restoration ; restoration techniques

INTRODUCTION

Composites may be explained as a hugely cross linked polymeric material that is augmented by a dispersion of amorphous silica, glass, crystalline or organic resin filler particles or terse strands that are bonded to the matrix by a coupling agent (Ashok and Jayalakshmi, 2017). In composites, two two or more specific phases are combined together to form a solid mass with enhanced properties that are proven superior to their own original individual properties. In endodontically treated teeth which have undergone root canal treatment, FRC (Fibre Reinforced Composites) are used (Ramamoorthi, Nivedhitha and Divyanand, 2015)**.** One of the most finest characteristics of composite restorative materials is it's aesthetic behaviour. It also exhibits precipitate forming behaviour when trialled as obturation material in root canal treatment.(Siddique et al., 2019). They tend to blend in with the original tooth colour.

Composites are used almost universally and they have less complexity in usage. Sometimes for an avulsed tooth, glass FRC can be used instead of a resin bonded appliance due to its absence of allergenic properties (Rajakeerthi and Ms, 2019). The other such advantages of composite materials include its strength, it's resistant nature to corrosion, repairable quality and also the fact that it's cheaper than porcelain (Nasim et al., 2018). In restorative dentistry,not complete removal of carious substances can be a huge problem. Use of chlorhexidine can be a good solution as it does not cause any secondary effect on composites (Noor and Others, 2016)**.**

Composite materials are also used in direct composite laminate veneers and indirect laminate veneers(Ravinthar and Others, 2018)**.** Some of the disadvantages present in composite materials include polymerisation shrinkage, higher coefficient of thermal expansion and increased occlusal wear. Some of the other factors that are of significance are low modulus of elasticity, last of anticariogenic property and time consuming of this material.

Composites can be classified into microfilled or traditional composite containing particles with size ranging from 8 to 12 micrometers; small particles filled composite with particles size ranging from 1 to 5 micrometers and microfilled composite materials, in which the particle size ranges from 0.6 to 1 micrometers (Fujihara et al., 2004). Composites were later classified based on their filler particles into megafill, macrofill, midifill, minifill, microfill and nanofill (Ganapathy et al., 2016)**.** In megafill, at the point of occlusal contact, 0.5 to 2 mm glass inserts are placed (Terry and Geller, 2009). In macrofilled composites, the particles range from 10 to 100 micrometers in diameter . In midifill composites, the particle size ranges from 1 to 10 micrometers in diameter . The much smaller microfill composite has particle size ranging from 0.01 to 0.1 micrometers. Finally, the smallest particle size ranges between 0.005 to 0.01 micrometers is the nano filled composite(Okuda, 2013). The bond stability can be reduced sometimes by the actions between the dentin hybrid bond layer and Matrix MetalloProteinase(Teja, Ramesh and Priya, 2018).Composite restorations can also be used in class 4 anterior fracture(Jose and Subbaiyan, 2020).

In conventional or macrofilled composite, the fillers most commonly used are finely ground amorphous silica or quartz(Menon, Karthikeyan and Raj, 2016). The recommended filler size is 8 to 12 micrometers. The microfilled composites are generally used in class 1, class 2 and class 4 restorations **.** In small particle composites, the fillers used are amorphous silica and glasses that contain heavy metals. The filler size used is 0.5 to 3 micrometers. The small particle composite is used in high stress and abrasion prone areas like class four restorations. They have good mechanical properties and provide good smoothness. In microfilled composites, the filler particles used are silica, or colloidal silica with organic fillers. The size of the fillers range from 0.04 to 0.4 micrometers. These microfill composites are used in anterior teeth, restoring sub gingival areas and carious lesions on smooth surfaces(Kumar and Jayalakshmi, 2016). The quality of composite resin for obturation is better than many other materials in terms of elasticity modulus and breaking pressure (Govindaraju, Jeevanandan and Subramanian, 2017). Composite materials are recommended in obturation of carious teeth. This is because chlorhexidine can be used to remove any excess carious material and composite does not react with it.(Nasser, Rupkumar and Junaid, 2019)

Hybrid composites are used in class four and class three restorations in anterior teeth; non stress bearing areas in posterior teeth. The filler size used is 0.4 to 1 micrometers(Hickel et al., 2010). Nano filled composite particles are extremely small and virtually invisible**.** Composite materials cause very little to no pulp damage (Janani, Palanivelu and Sandhya, 2020). For high strength, FRC posts are used in root canal treatment(Ramanathan and Solete, 2015)**.**Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J et al., 2018; Menon et al., 2018; Prabakar et al., 2018; Rajeshkumar et al., 2018, 2019; Vishnu Prasad et al., 2018; Wahab et al., 2018; Dua et al., 2019; Duraisamy et al., 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu et al., 2019; Mehta et al., 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran et al., 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma et al., 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi et al., 2020; Samuel, Acharya and Rao, 2020)

The aim and goal of this survey is to find out the most preferred composite restorative material for anterior and posterior restorations among PG dental students and PG graduated dental practitioners.

MATERIALS AND METHODS

This survey is a descriptive and cross section survey based approach in which a questionnaire containing 15 questions was distributed through an online platform called Google Forms. Using online platforms for conducting the survey allows reaching out to a wide range of people. The survey was attended by 109 participants which included PG dental students and PG graduated dental practitioners from Chennai. The only criteria included was that the participant should be a dental practitioner. The sampling method followed is a random sampling method.

A questionnaire containing 15 questions was distributed and answers were collected through Google Forms in May 2020. Data assessment was made in Excel spreadsheets and the list of output variables was assessed. The statistical analysis was made through SPSS software. Chi square test was used and Pearson correlation analysis was used to assess the correlation between the variables. The results were considered to be of statistical significance if $p < 0.05$.
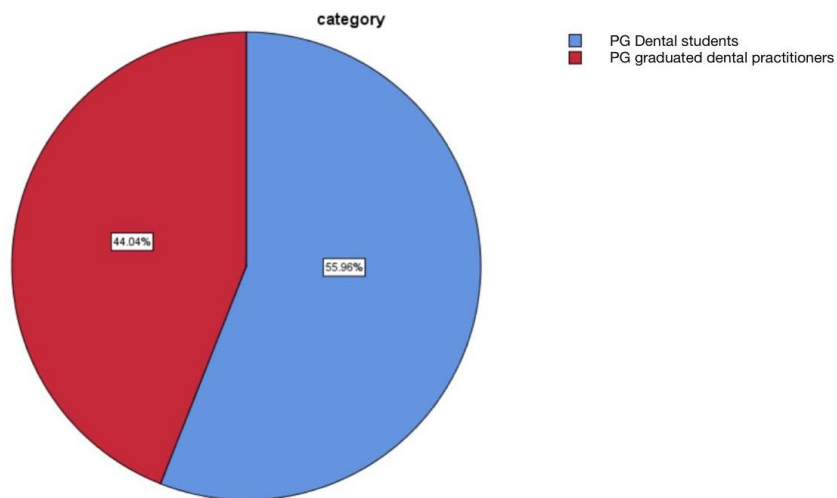
RESULTS AND DISCUSSION

Fig.1: Pie chart showing the category in which the participants belong to. 55.96% of the participants are PG dental students (blue) and 44.04% are PG graduated dental practitioners (red).
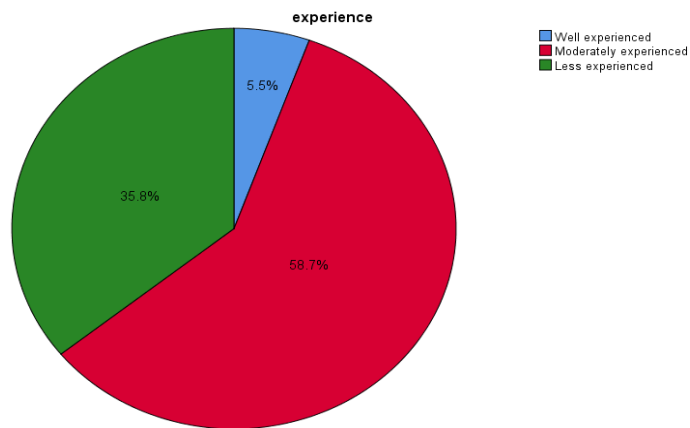

Fig.2 : Pie chart showing the experience of the participants in restorative dentistry. 5.5% are well experienced (blue), 58.7% are moderately experienced (red) and 35.8% are less experienced (green).
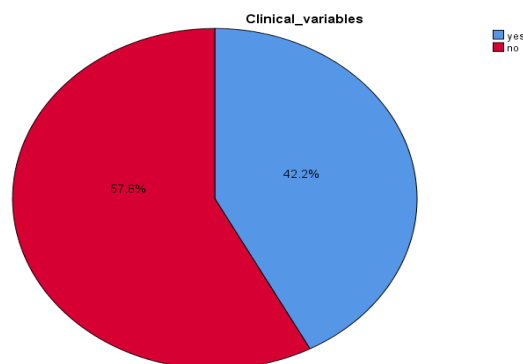

Fig.3 : Pie chart showing the respondents' opinion on if clinical variables affect the performance of composite materials. 42.2% say clinical variables affect (blue) and 57.8% say clinical variables don't affect the performance (red).
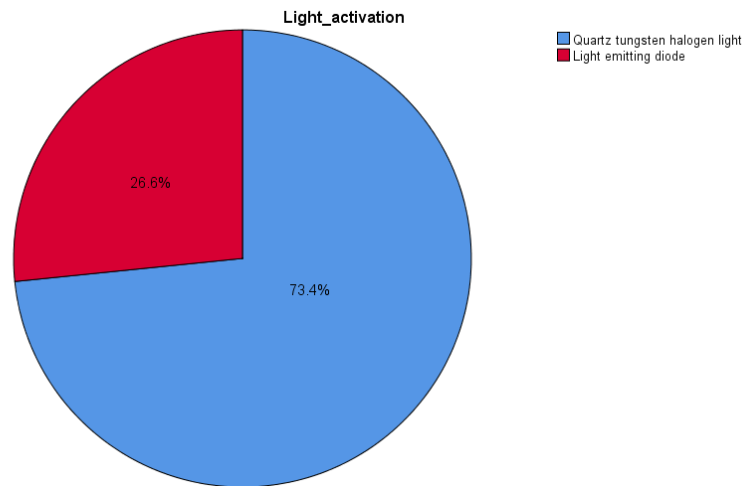
Fig.4: Pie chart showing the preference of light activation method among the participants. 73.4% prefer Quartz tungsten halogen light (blue) and 26.6% prefer light emitting diodes (red).
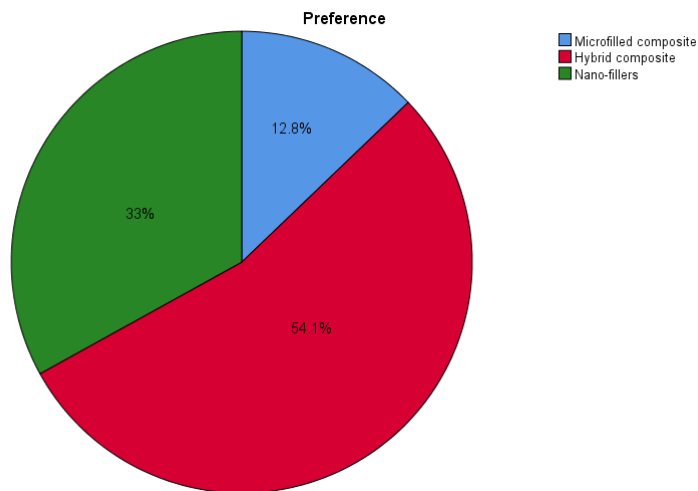

Fig.5: Pie chart showing the respondents preferences on restorative materials for anterior restoration. 12.8% prefer Microfilled composites (blue), 54.1% prefer hybrid composite (red) and 33% prefer Nanofillers (green).
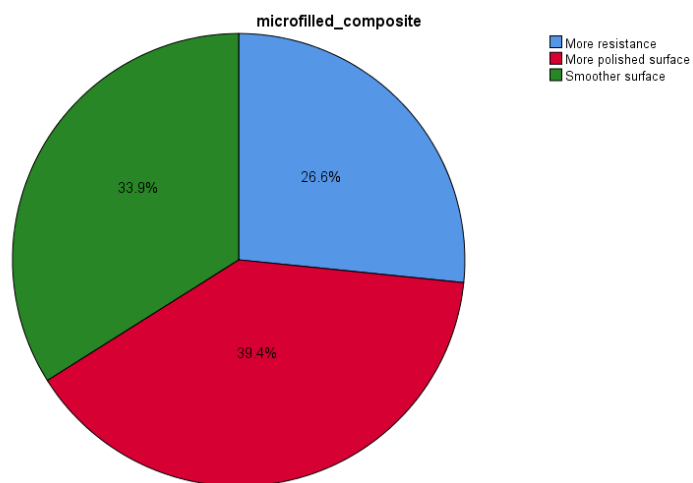

Fig.6 : Pie chart showing the reason the respondents choose Microfilled composite as their preferred option. 26.6% is due to more resistance (blue), 39.4% due to more polished surface (red) and 33.9% due to smoother surface (green).
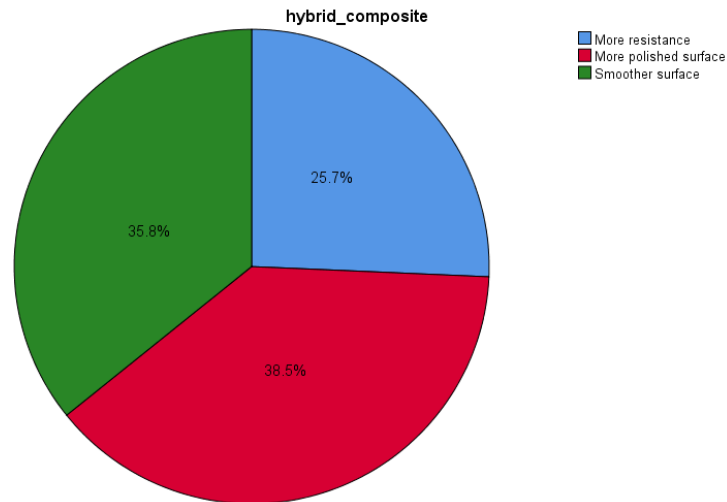
Fig.7: Pie chart showing the reason the respondents chose hybrid composite as their preferred option. 25.7% is due to more resistance (blue), 38.5% due to more polished surface (red) and 35.8% due to smoother surface (green).
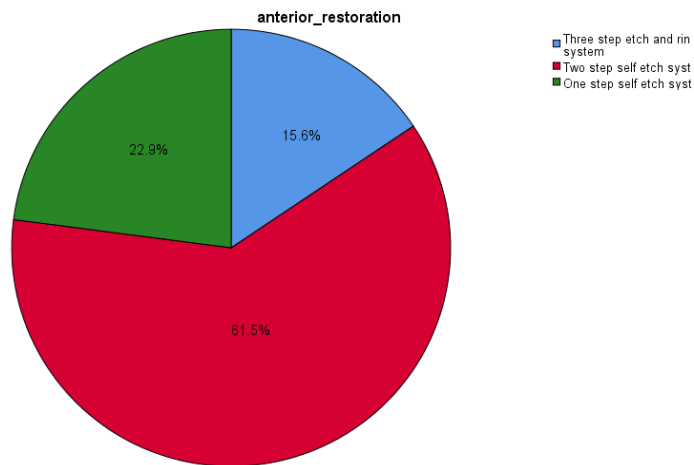

Fig.8 : Pie chart showing the preference of the participants in the etching system. 15.6% prefer three step etch and rinse system (blue), 61.5% prefer two step self etch system (red) and 22.9% prefer one step self etch system (green).
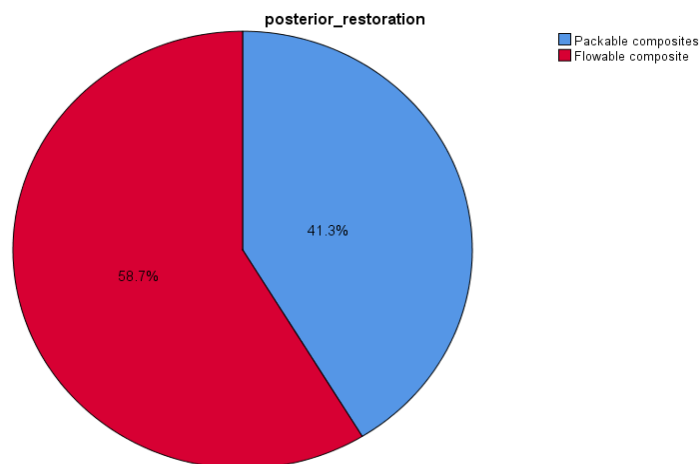

Fig.9 : Pie chart showing the participants' preferred composite material for posterior restoration. 41.3% prefer packable composites (blue) and 58.7% prefer flowable composites (red).
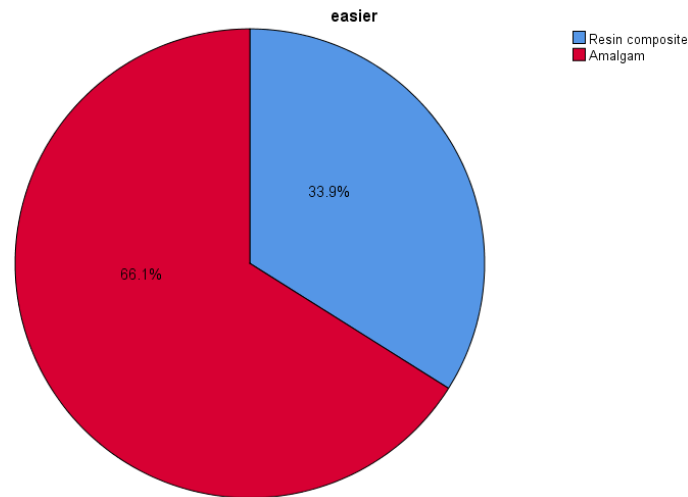
Fig.10 : Pie chart showing the participants' choice in easier place posterior restoration. 33.9% prefer resin composites (blue) and 66.1% prefer amalgam (red).
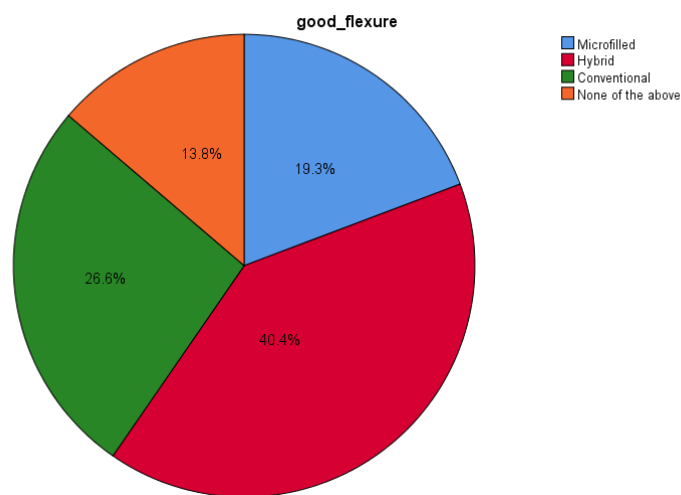
Fig.11 : Pie chart showing the respondents restoration of choice in class 5 cavities. 19.3% chose Microfilled composites (blue), 40.4% chose hybrid composite (red), 26.6% chose conventional composite (green) and 13.8% chose none of the above (orange).

Fig.12 : Pie chart showing the participants opinion on purpose to which etching is done. 16.5% responded to increase the surface area 2000 times (blue), 47.1% to create surface irregularities to aid in mechanical interlocking (red), 28.4% to allow proper adaptation and to decrease marginal leakage (green) and 7.3% chose all of the above (orange).

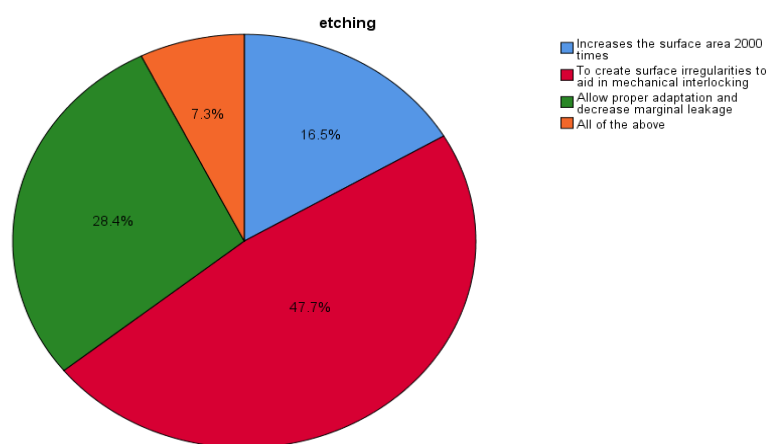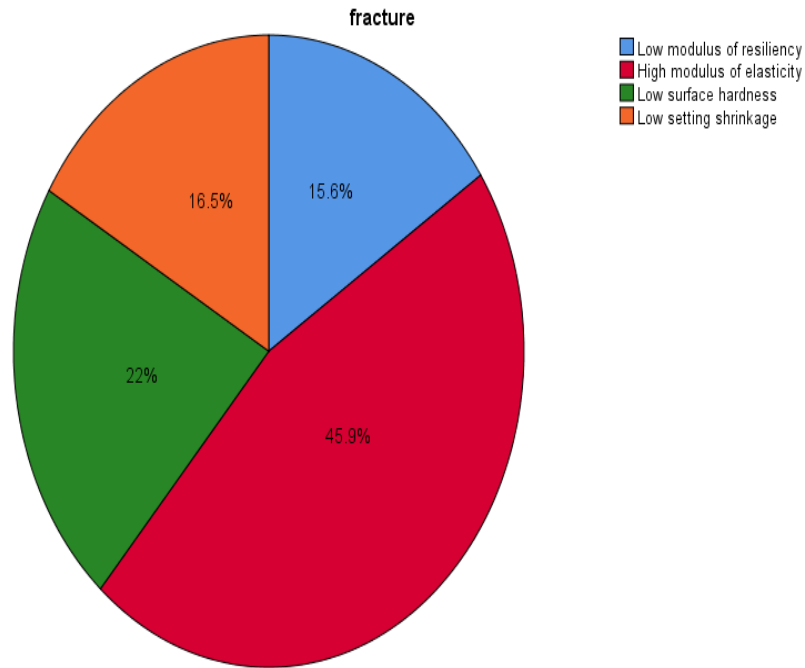**Fig.13 : Pie chart showing the respondents opinion on the reason for crazing, cracking and wear fracture of the composite. 15.6% responded it was due to low modulus of resilience (blue), 45.9% due to high modulus of elasticity (red), 22% due to low surface hardness (green) and 16.5% due low setting shrinkage (orange).**

Fig.14 : The bar graph represents the comparison of responses by participants of varying qualification in dentistry on their preferred method of light activation. X axis represents the category in which the participants belong and Y axis represents percentage of participants' response on the methods of light activation. This graph shows that PG dental students prefer using Quartz tungsten halogen light more than the PG graduated dental practitioners. However, this was not statistically significant. Chi square test, p-value = 0.439 (>0.05), hence statistically not significant.

Fig.15 : The bar graph represents the comparison of responses by participants of varying qualification in dentistry on their preferred restorative materials for anterior restoration. X axis represents the category in which the participants belong and Y axis represents the percentage of the participants' response on their preferred composite materials. As the graph shows that there is no significant difference between the preferences on composite materials, the PG dental students' preferences on hybrid composite and are similar to that of the PG graduated dental practitioners. Chi square test, p-value = 0.460 (>0.05), hence statistically not significant.
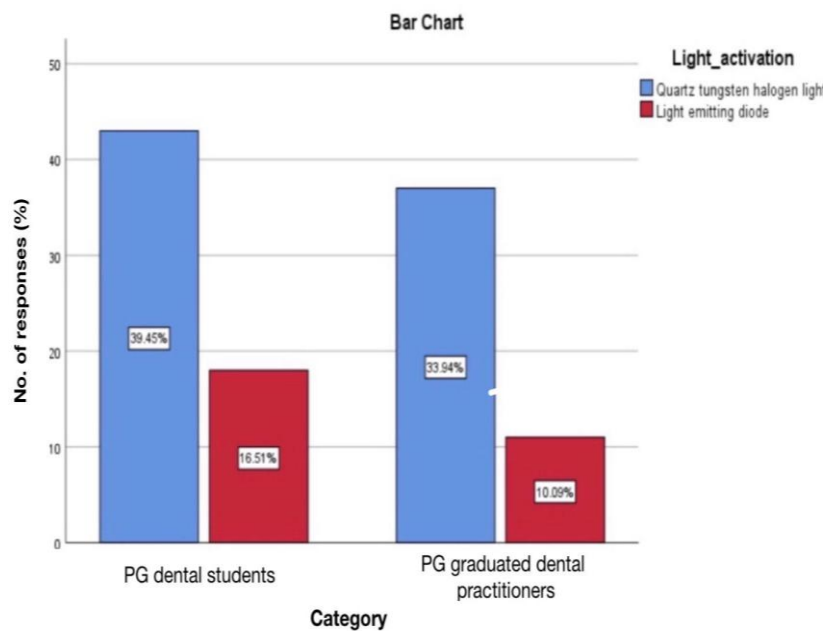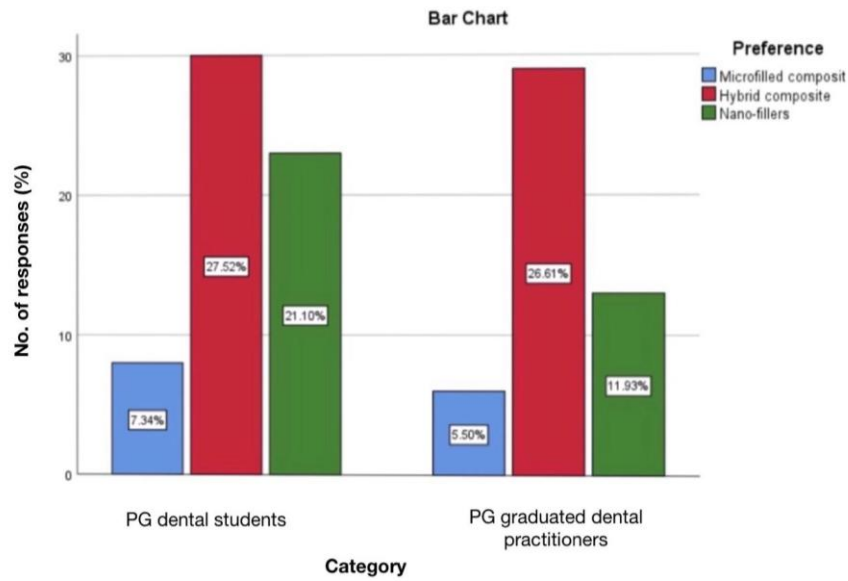

Fig.16 : The bar graph represents the comparison of responses by participants of varying qualification in dentistry on their preferred easily placeable restorative material for posterior restoration. X axis represents the category in which the participants belong and Y axis represents the percentage of the participants' response on easier placeable restorative material. Majority of the PG dental students prefer amalgam as easily placeable for posterior restoration than PG graduated dental practitioners. However, the difference is not significant statistically. Chi square test, p-value = 0.905 (>0.05), hence statistically not significant.
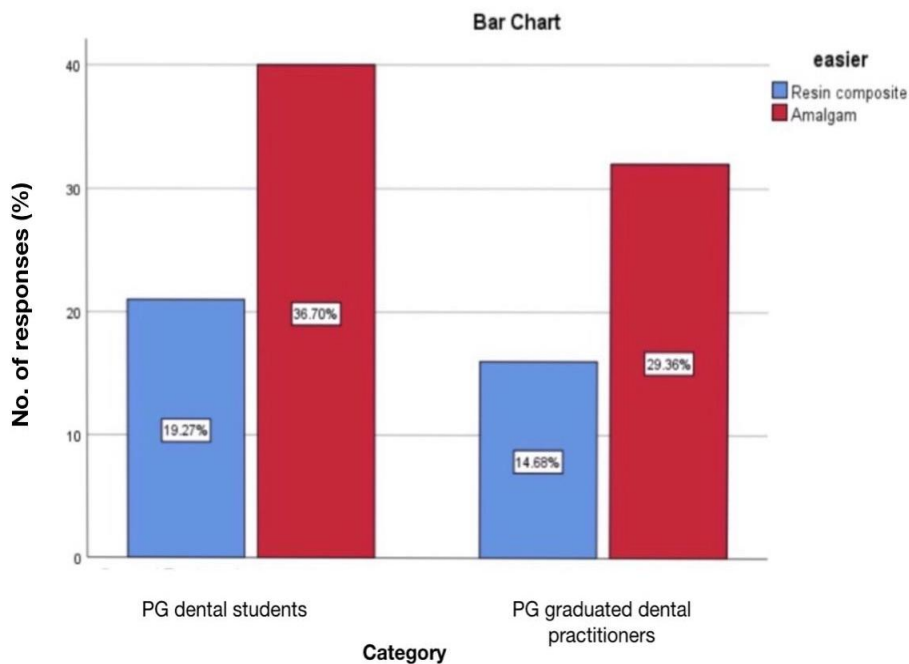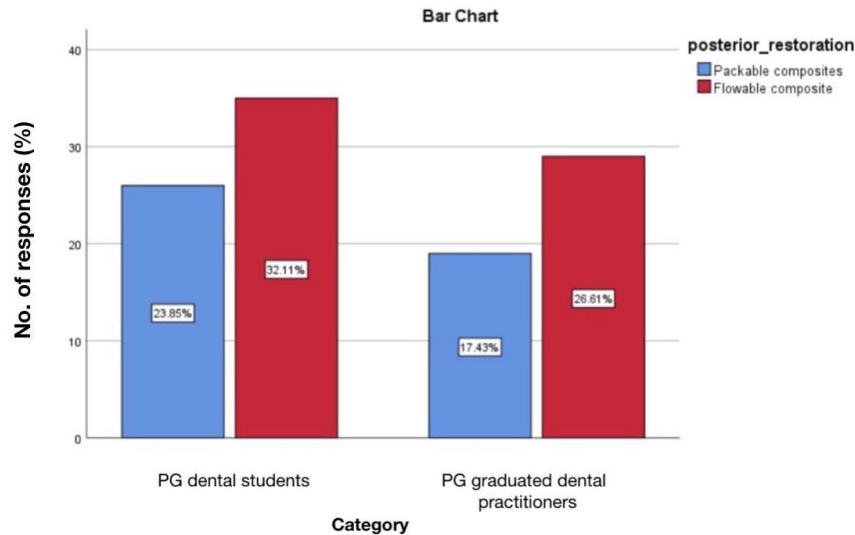
Fig.17 : The bar graph represents the comparison of responses by participants of varying qualification in dentistry on their preferred composite material for posterior restoration. X axis represents the category in which the participants belong and Y axis represents the percentage of the participants' preferred composite material for posterior restoration. This graph shows that the majority of the PG dental students prefer flowable composite material for posterior restoration than PG graduated dental practitioners. However, this was not statistically significant. Chi square test, p-value = 0.749 (>0.05), hence statistically not significant.

From figure 1, we can see that among the total participants, 55.96% PG dental students attended the survey and 44.04% of the attended participants were PG graduated dental practitioners. We can see from Figure 2 that the participants had different views about their experience in restorative treatment. It was found that 5.5% of the participants were well experienced, 58.7% of the participants were moderately experienced and the remaining 35.8% were less experienced.

The participants were asked if they think besides the type and brand of the dental materials, clinical variables affect the performance of composite restorations . 42.2% of them agreed to that while 57.8 did not, as shown in figure 3. Dermaco, et.al, conducted a survey among dental practitioners regarding their choices and preferences on molar restoration. It was a web based study with a sample size of 120 (Demarco et al., 2013). Similar responses were not seen in that survey as this one as the majority of the participants (53%) in that survey thought the clinical variables affect the performance of composite restoration besides the type and brand of the dental materials.

In figure 4, it is seen that the participants were asked to choose their preferred method of light activation. 73.4% chose light emitting diodes while 26.6% chose Quartz tungsten halogen light. Reduction of polymerisation contraction stress of composites using various sources are discussed by BS Lim, et.al,(Lim et al., 2002). As depicted in figure 5, PG dental students and PG graduated dental practitioners were asked about the preferred restorative materials for anterior restoration. 12.8% preferred micro filled composites, 54.1% preferred hybrid composites while 33% of them preferred nano fillers . When the participants were interrogated why they would choose micro filled composite for anterior restoration, 26.6% responded as for more resistance, 39.4% for polished surface and the remaining 33.9% for acquiring smoother surfaces. Their choice can be supported by the characterisation given by HS Germain on microfilled composite resins. It is mentioned there that micro filled composites provide more resistance(Germain et al., 1985).

When the participants were interrogated why they would choose micro filled composite for anterior restoration, 26.6% responded as for more resistance, 39.4% for polished surface and the remaining 33.9% for acquiring smoother surfaces. This opinion of the participants is strongly supported by Raptis C.N in his article which describes the good quality polishing of micro filled composite (Raptis, Fan and Powers, 1979). Previously, a study was done by Al Negrish, et.al, the survey included the opinion of general dental practitioners regarding anterior composite restoration. The sample size of that survey was 276. In that survey, 68% of the dentists chose microfilled composite when they were asked about their preferred material for obtaining a polished surface. (Al-Negrish, 2002).

As shown in figure 7, the participants were asked the reason for they chose hybrid composite for anterior restoration. It was found that they chose hybrid composite to be more resistant by 25.7% of the participants, 38.5% for polished surface, 35.8% for smoothness. The renowned properties of hybrid composites are described by Lee DC in his study(Lee and Jang, 1996). Figure 8 shows the responses by the participants about their

preferred etching technique. 15.6% of the dentists prefer 3 step etch and rinse, 61.5% prefer two step self etch system while 22.9 % prefer one step self etch method of etching. As seen in figure 9, the participants's preference on packable and flowable cements were asked. 58.7% of the participants seemed to prefer flowable composites while 41.3% preferred packable composites. The advantages of flowable composites over packable composites are detailedly expressed by Braga RR(Braga, Hilton and Ferracane, 2003). 66.1% of the PG dental students and PG graduated dental practitioners find that amalgam is easier to be placed in posterior restoration while 33.9% find rein composite to be much more easier in posterior restoration as shown in figure 10. The participants were asked which composite exhibited good flex use and used in class five cavities. As per figure 11, 19.3% answered Microfilled composites, 40.4% answered hybrid composite and 26.6% answered conventional composite and 13.8% responded none of these. This is in contradiction to the survey conducted by Hashin Z in which 55% of the participants chose microfilled composite as the composite that was used in class 5 cavities(Hashin, 1983).

According to figure 12, 16.5% of the participants responded that the purpose of etching enamel before placing composite is to increase surface irregularities to aid in mechanical interlocking and 28.4% to allow proper adaptation and decreased marginal leakage while 7,3% responded that it is because of all these factors. As seen in Figure 13, 15.6% answered that the wear fracture of composite is due to low modulus of resilience, 45.9% due to high modulus of elasticity, 22% due to surface hardness and 16.5% due to low setting shrinkage.

A comparison between dentists with various qualifications on different light activation methods was made through Chi square analysis (Figure 14). There seemed no significant difference as the p-value was 0.439. Figure 15 represents the association between qualification of the dental practitioner and their respective preferences on composite materials for restoration and its Chi square analysis. There is no significant difference observed (p-value = 0.460). The chi square analysis of comparison on preferred easily usable restorative materials among dentists with various qualifications (Figure 16) and found that there is no significant difference is seen in between the various dentists (p-value = 0.905). Comparison of preferred composite materials for posterior restoration among dentists with various qualifications is depicted in Figure 17 with its chi square analysis. The p-value was found to be 0.749 which denotes there is no significant difference in the results.

There aren't quite many articles or surveys that were conducted to find the preferences in restorative materials by dental practitioners. So there aren't many surveys based on restorative material options and choices. There is an article by Gordon, et.al, which is more likely to resemble this study. The survey was attended by 187 Brazilian dentists. The questionnaire contained questions regarding the choices of restorative materials in posterior restoration. A similar result is seen in this survey conducted regarding the composite choice in posterior teeth(Gordan et al., 2000). It was seen that for posterior restoration, amalgam was considered to be done easier by 52% of the participants, which goes by our result. The limitations in this study includes average knowledge on various restorative materials in a few participants and carelessness while attending the survey. The less number of participants in this survey can also be considered.Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh et al., 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai et al., 2019; Sridharan et al., 2019; Vijayashree Priyadharsini, 2019; Mathew et al., 2020)

CONCLUSION

Composites have a wide range of variety, altering functions and useful properties that evolve with advances. This survey was attended by 109 participants among whom 55.96 are PG dental students and 44.04% are PG graduated dental practitioners from Chennai. The experience of these dental practitioners ranges from well experienced to relatively less experienced in the field of restorative dental therapy. Within the limitations mentioned above, we could conclude that for anterior restorations, hybrid composite is preferred by the majority of PG dental students and PG graduated dental practitioners. As far as posterior restoration is considered, flowable composites are seen to be preferred over packable composites.

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Questionnaire

1. Are you a (PG dental students/ PG graduated dental practitioners)
2. How long have you been practising dentistry?
3. How experienced are you in doing restorative treatment? (Well experienced/ moderately experienced / less experienced)
4. Do you think beside the type and brand of dental materials, clinical variables significantly affect the performance of composite restorations? (Yes / no)
5. Which is your preferred method of light activation? (Quartz tungsten halogen light / Light Emitting Diodes)
6. Which restorative material do you prefer for anterior restoration? (Microfilled composites/ hybrid composites/ Nanofillers)
7. Mention the reason for your preference in the previous question
8. Why would you use microfilled composite for anterior restoration? (More resistance/ more polished surface/ smoother surface)
9. Why would you use hybrid composite for anterior restoration? (More resistance/ more polished surface/ smoother surface)
10. Which of these systems do you prefer for perfect anterior restoration? (Three step etch and rinse / two step self etch system/ one step self etch system)
11. What is your preferred composite for posterior restoration? (Packable composites/ flowable composites)
12. Which restorative material is easier to place in posterior restoration? (Resin composites/ amalgam)
13. The composite that exhibits good flexure and is restoration of choice in classV cavities is (Microfilled/ hybrid/ conventional/ none)
14. Purpose of etching enamel before placing composite is (To increase the surface area 2000 times / to create surface irregularities to aid in mechanical interlocking/ allow proper adaptation and decrease marginal leakage/ all of the above)
15. Crazing, cracking and wear fractures of the composites is due to (Low modulus of resilience / high modulus of elasticity/ low surface hardness/ low setting shrinkage)