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Knowledge and Awareness of Fluoride Releasing Dental Materials

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Abstract: Aim: The aim of the study is to create awareness about fluoride releasing dental materials.
Introduction: Fluoride was introduced in dentistry over 70 years ago and it is now recognised as the main factor responsible for the dramatic decline in caries prevalence that has been recorded and observed worldwide. The effect of fluoride on demineralisation and remineralisation of incipient caries lesion in enamel and dentin is recognised as the most important mechanism of fluoride action.
Materials and method: The sample size of the study was about 300 participants of undergraduate dental students. A set of questionnaires is being created by the use of google form software, the data collection software score and represent the participants answer in pie chart.
Result: After getting statistical analysis results. It is clear that people were moderately aware about the fluoride releasing dental materials.
Conclusion: The report had concluded about the role of fluoride releasing dental materials and its property of increasing the efficiency of caries control and preventing biofilm formation. From the limitations of the survey, students were moderately aware about the fluoride releasing dental materials.

Keywords: Fluoride release; secondary caries; demineralisation; fluoride releasing restoratives; remineralisation.

INTRODUCTION

Fluoride was introduced into dentistry over 70 years ago and it is now recognised as the main factor responsible for the dramatic decline in caries prevalence that has been recorded and observed worldwide (Featherstone, 2000). The effect of fluoride on remineralisation and demineralisation of incipient caries lesion in enamel and dentin is recognised as the most important mechanism of fluoride action (Glasspoole, Erickson and Davidson, 2001). The initial carious lesions should be exposed to the aqueous phase of fluoride for a prolonged period of time to achieve the cariostatic effect (Hicks *et al.*, 2000)(Hicks *et al.*, 2002). Fluoride present in sustained, low concentrations in the oral fluids during an acidic challenge may be able to absorb to the surface of the apatite crystals which inhibit demineralisation (Mitra *et al.*, 2011). When the pH is reestablished, fluoride in solution will be supersaturated with respect to fluorohydroxyapatite in order to speed up remineralization. Fluoride releasing dental materials can prevent caries but when caries extend to pulp then root canal treatment is done and there may be some post operative pain (Ramamoorthi, Nivedhitha and Divyanand, 2015). Cone beam computed tomography can also be used to evaluate the root canal preparation (Ramanathan and Solete, 2015). Evaluation of efficacy of natural products as compared to conventional dental materials can also be studied [(Siddique *et al.*, 2019). Glass ionomer cement are fluoride releasing restorative materials and they help to release fluoride around restorations. In order to slow down the osseous replacement of the avulsed tooth, before replantation treatment of the root surface with fluoride has been suggested (R, Rajakeerthi and Ms, 2019). The disadvantage of these materials are inferior translucency compared to resin based materials and low initial mechanical properties. Fluoride helps in remineralisation. Remineralization involves inducing hydroxyapatite crystals to grow by precipitation of Ca2+ and PO43- ions from saliva onto the surface of the mineral phase (Rajendran *et al.*, 2019).

Hybrid materials are the combination of glass ionomer cements and composite resins were developed to help overcome the problems of the conventional glass ionomer cements. Resin modified glass ionomer cement has been introduced as fluoride releasing restorative materials and they may offer fluoride release around restorations (Nasim *et al.*, 2018).

Fluorides prevent biofilm formation, sometimes the yellow discolouration of the crown is due to deposition of hard tissue inside the root canal (Kumar and Delphine Priscilla Antony, 2018). Topical fluoride causes surface

changes in veneer porcelain (Ravinthar and Jayalakshmi, 2018). Fluoride releasing GIC can also be added with chlorhexidine which improves the antimicrobial activity (Noor, S Syed Shihaab and Pradeep, 2016). Moreover, fluoride precipitated onto the tooth surface in the form of CaF2 serves as a reservoir of fluoride when pH drops. If caries enter the pulp it causes inflammation of the pulp (Ramesh, Teja and Priya, 2018). Fluoride is more effective towards secondary caries but when the caries extend to the pulp, then the dental pulse oximeter is used to evaluate the vitality of the pulp (Janani, Palanivelu and Sandhya, 2020). Previous studies of the fluoride releasing properties of composite resins indicate a long term release of fluoride even though the amount of fluoride released is low in comparison with that of glass ionomer cement and compomers. If the teeth are exposed to more fluoride, then the enamel is pitted and discolored and is prone to fracture (Jose, P. and Subbaiyan, 2020).

Fluoride releasing dental materials are most commonly used in dentistry to prevent dental caries and to speed up the process of remineralisation. But furthermore awareness is needed to improve the usage of fluoride releasing dental materials clinically. 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 of the study is to create awareness about fluoride releasing dental materials.

MATERIALS AND METHOD

The sample size of the study is about 300 participants and the sampling method is a simple random simplifying method and a set of questionnaires is being created by the use of google form software and at the end of the survey, the data collection software core and represent the participant answers a pie chart .

Statistical test used **:** Chi square test

Statistical software used **:** SPSS

Inclusion criteria **:**

Undergraduate dental students.

Exclusion criteria **:**

Postgraduate dental students and dental practitioners

RESULTS AND DISCUSSION

After getting statistical analysis results. It is clear that people were moderately aware about the fluoride releasing dental materials. Among 300 respondents, 69% of people were aware about the fluoride releasing composite resins and 22% of people don't know about the composite resins. (Fig 1) majority of people were aware about the composite resins .

Majority of people (44.it helps in remineralisation (fig 2). About the fluoride release ability of GIC, 68% of people think that GIC delays setting reactions (fig 3). About fluoride uptake in enamel and dentine, 74 % people agree that it reduces secondary caries.

Majority of people (54%) think that environmental factors help in fluoride release (fig 5).

74% of people agree that fluoride releasing dental materials are clinically effective on caries control (fig 6). 67% of people agree that it prevents biofilm formation (fig 7).

Majority of people (66%) know about pit and fissure sealers which release fluoride (fig 8). 63% of people say it starts to release fluoride after 30 days (fig 9). Majority of people (40%) use GIC clinically and 28% of people use composites & 18% people use pit and fissure sealants clinically.

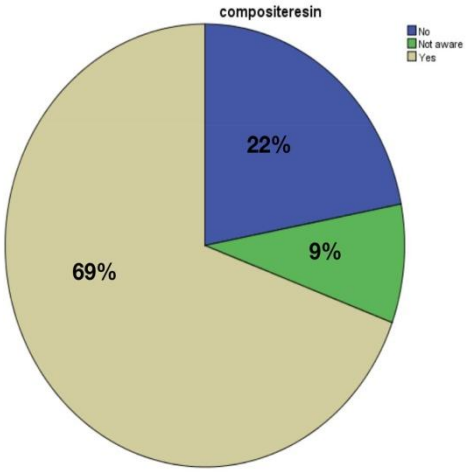

Figure 1: Pie chart showing the responses to the question : Awareness on fluoride releasing dental material. 69% of people were aware about the fluoride releasing composite resins and 22% of people don't know about the composite resins.

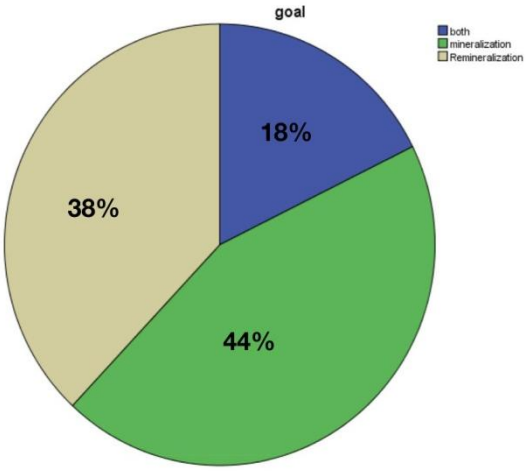

Figure 2: Pie chart showing the responses to the question :The ultimate goal of fluoride release. 44% of people agree that it helps in mineralisation and 38 % people agree that it helps in remineralisation.

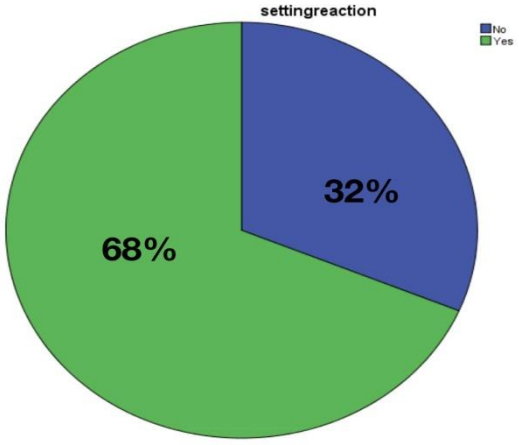

Fig 3: Pie chart showing the responses to the question: Does the fluoride releasing ability of GIC delays setting reaction. 68% of people think that GIC delays setting reactions.

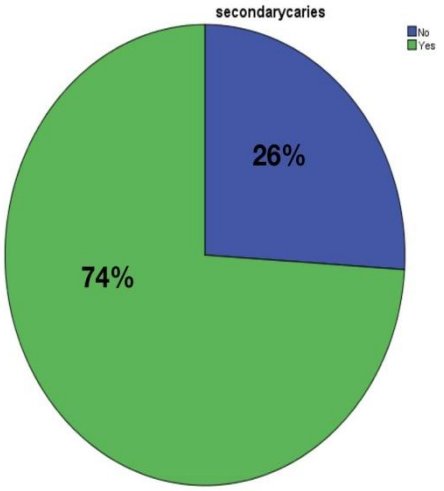

Fig 4 : Pie chart showing the responses to the question: Fluoride uptake into the enamel and dentin reduce the incidence of secondary caries. 74% of people agree that fluoride uptake into enamel and dentin reduces the incidence of secondary caries.

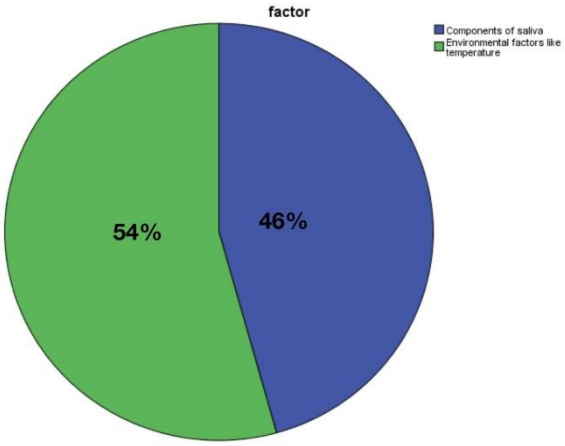

Fig 5: Pie chart showing the responses to the question: Factors help to release fluoride. 54% people think that environmental factors help in fluoride release. 46% of people agree that components of saliva helps in fluoride release.

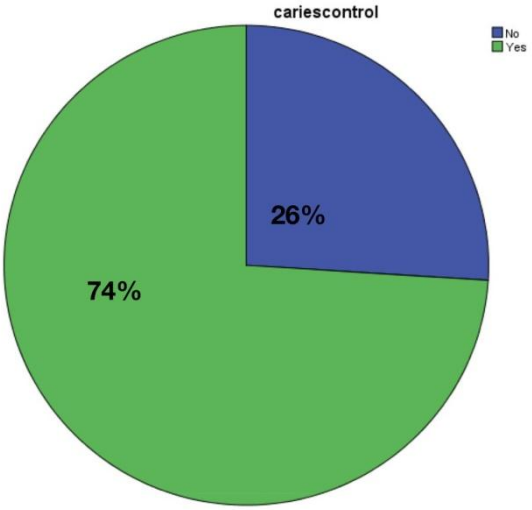

Fig 6: Pie chart showing the responses to the question: Fluoride releasing dental materials clinically effective on caries control. 74% People agree it is clinically effective in caries control and 26 % of people think that it's not clinically effective in caries control.

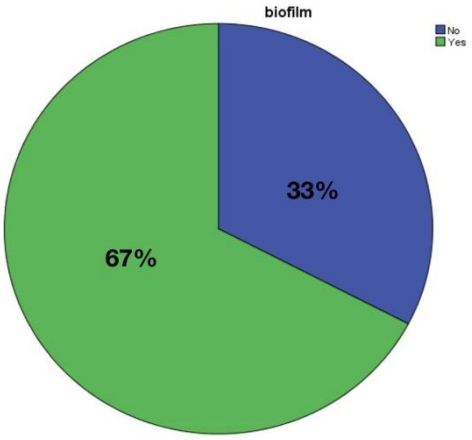

Fig 7: Pie chart showing the responses to the question: Does fluoride releasing dental materials prevent biofilm formation. 67% of people agree that it prevents biofilm formation and 32% of people think that it does not prevent biofilm formation.

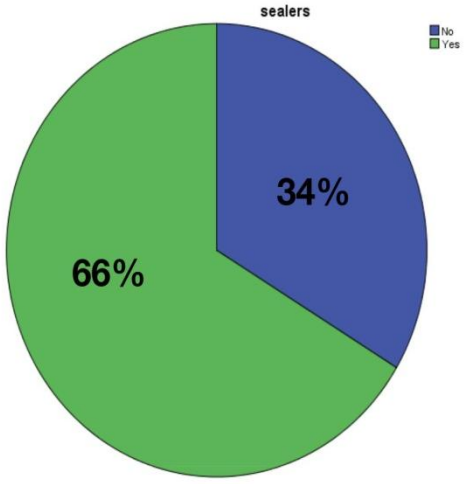

Fig 8: Pie chart showing the responses to the question: Does pit and fissure sealers release fluoride. 66%People were aware about the fluoride releasing pit and fissure sealant and 33% of people were not aware.

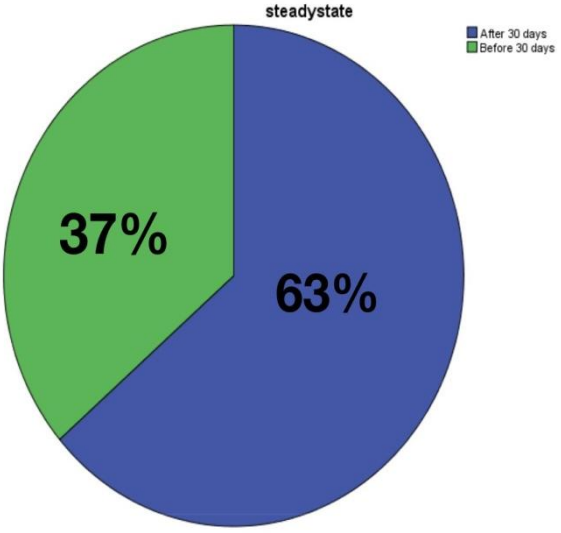

Fig 9: Pie chart showing the responses to the question: Study state release of fluoride. 63% of people say it starts to release fluoride after 30 days and 36 % of people say before 30 days

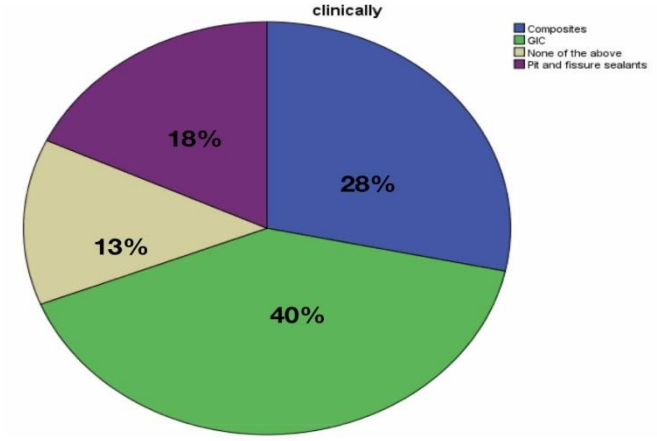

Fig 10: Pie chart showing the responses to the question: Fluoride releasing dental materials which had been used clinically. 40% of people used GIC, 28% of people used composite, 18 % of people used pit and fissure sealant and 13 percent of people have not used the things mentioned.

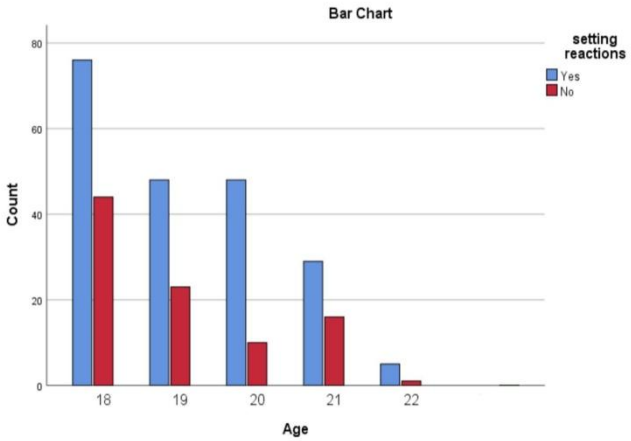

Fig 11: The bar chart representing the association between age and setting reaction awareness X axis represents age and Y axis represents setting reaction awareness. (p= 0.00) statistically significant

Association between age and setting reaction was done using chi square test (p = 0.00) and was found to be statistically significant. Out of 68 % of people who agree it delays setting reactions, 76 % people were 18 years of age and 45% of people were 19 years of age .

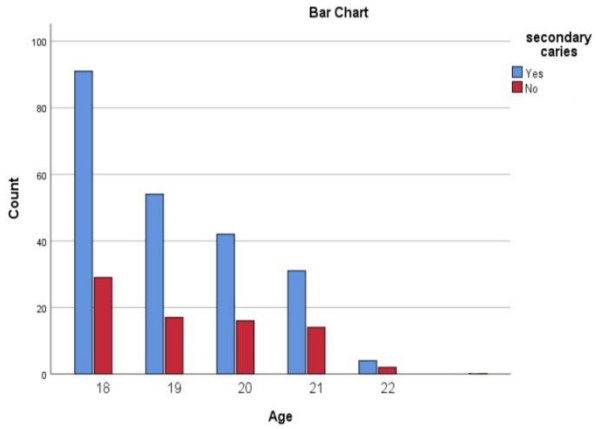

Fig 12: The bar chart representing the association between age and secondary caries awareness X axis represents age and Y axis represents secondary caries awareness

Association between age and secondary caries was done using chi square test (p = 0.00) and was found to be statistically significant. Out of 74% of people who agree it prevents secondary caries, 85 % people were 18 years of age and 46% of people were 19 years of age .

About fluoride releasing composite resins, 69% of people were aware about composite resins (fig 1). Composite restorations are in constantly increasing demand. Advantage of composite resin is long term release of fluoride. During the root canal treatment the shape of the root should be optimal to clean more (Manohar and Sharma, 2018). Fluoride is also present in intracanal medicament. Silver diamine fluoride is an endodontic medicament with high antimicrobial activity (Nasim and Nandakumar, 2018). Resin composites contain fluoride in forms, such as inorganic salts, leachable glasses or organic fluoride. Hence, not only the amount of fluoride but also particle size and type of the fluoridated filler, silane treatment, the type of resin and porosity may be important factors contributing to fluoride release fluoride are not effective towards enamel erosion but extracts from grape seed and cranberry are more effective (Teja and Ramesh, 2020).

About the goal of fluoride release of dental materials , 44% people answered that it helps in mineralisation , 38 % of people think it helps in remineralisation and 17 % of people think it helps in both the process (fig 2). Fluoride present in low, sustained concentration helps in inhibiting demineralisation and speed up the process of remineralisation (Gao and Smales, 2001).

Fluoride's principal role in inhibiting decay is now considered to be its effect on the remineralization process. Mainly, it promotes this process, thereby re-establishing the mineral phase of the affected tooth. Remineralization involves inducing hydroxyapatite crystals to grow by precipitation of Ca2+ and PO43- ions from saliva onto the surface of the mineral phase.

About the fluoride release ability of GIC delays setting reaction, 68% of people agree that GIC delays setting reaction and 31% of people say that fluoride releasing GIC does not delay setting reaction(fig 3). Modified GIC are able to form strong adhesive bonds to both enamel and dentine; they also release fluoride (Attar and Onen, 2002).

Glass-ionomer cements consist of fluoride containing silicate glass and polyalkenoic acids which are set by an acid–base reaction between the components. During the setting reaction a variety of ionic constituents is released from the glass which also includes fluoride.

About fluoride uptake in enamel and dentin reduce secondary caries, 72% of people agree that it prevents or reduces secondary caries and 26% of people say it does not reduce secondary caries (fig 4). Effect of fluoride on demineralisation and remineralisation of incipient carious lesion in enamel and dentin is recognised as an important mechanism (Dionysopoulos, Kotsanos and Pataridou, 2003).

After restoration placement, fluoride is released during the setting reaction and for periods up to 8 years. The fluoride which is released is readily taken up by the surface of the tooth structure like cavosurface. Resistance against caries along the cavosurface and the adjacent smooth surface has been shown in previous studies.

About factors which help reduce fluoride,54% people think that environmental factors help in fluoride release and 45 % of people say components of saliva helps in fluoride release which constantly contact with restoration (fig 5) (Bansal, 2015).

The fluoride releasing capacity differs from one restorative material to the other and also depends on the oral environment, such as pH of saliva. Fluoride precipitated by a restorative material and released into the oral environment in the form of CaF2, which serves as a reservoir of fluoride when the pH drops.

About fluoride releasing dental materials clinically effective on caries control, 74% People agree it is clinically effective in caries control and 26 % of people do not agree with it (fig 6).

Fluoride releasing materials are not able to interfere with the formation of biofilm on dental surfaces adjacent to them or else to inhibit acid production by dental biofilms. Hence fluoride slows down the progression of the caries.

Fluoride releasing dental materials prevent biofilm formation. 67% of people agree that it prevents biofilm formation and 32% of people do not agree with it (fig 7)

The fluoride released from GIC helps to prevent biofilm formation mainly in its early phases. GIC can actively prevent microbial biofilm formation, but anyway biofilms modulate the release of fluoride from GIC materials.

About pit and fissure sealers which release fluoride, 66%People know about the pit and fissure sealant which release fluoride and 33% of people were not aware (fig 8). pit and Fissure sealers which release fluoride have the ability to inhibit enamel demineralisation(Wiegand, Buchalla and Attin, 2007).

About steady-state release of fluoride, 63% of people say it starts to release fluoride after 30 days and 36 percent of people say before 30 days (fig 9).

The fluoride releasing ability seems to be similar between resin-modified and conventional GIC in that release is high in the first day, and slows from the second day, at last stabilizing to a steady release by almost 7 days.

About dental materials which had been clinically used 40% of people used GIC, 28% of people used composite, 18 percent of people used the pit and fissure sealant and 13 percent of people have not used the things mentioned (fig 10).

Less sample size was a limitation of the study.
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; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

CONCLUSION

The report had concluded about the role of fluoride releasing dental materials and its property of increasing the efficiency of caries control and preventing biofilm formation. From the limitations of the survey, students were moderately aware about the fluoride releasing dental materials.

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