Allergies caused due to monomers and modified monomer acrylic knowledge among dental practitioners-A Survey

Comment [D1]: Title seems confusing. Please give it an appropriate meaning.

ABSTRACT

Poly(methyl methacrylate) (PMMA) has been the most extensively used denture base material over the past eight decades. Despite the availability of alternative polymers, this has remained the dominant denture base material. To solve the limitations of PMMA, new materials have been developed and introduced into dentistry (1). Several adjustments have been tried to improve the physico-mechanical properties and biocompatibility of denture base acrylic resins. These modifications are divided into two categories: polymer and monomer alterations.

Comment [D2]: This abstract need proper arrangement. Seeing this abstract, it can be said that the readers wouldn't be interested to read it further.

Comment [D3]: Why the reference number is here?

KEYWORDS

Denture base; Modifications, Allergy; Acrylic; stomatitis

Comment [D4]: These keywords need modifications. Try to add some more and new keywords.

INTRODUCTION:

For the past eight decades, poly(methyl methacrylate) (PMMA) has been the most widely used denture base material. Despite the availability of alternative polymers, this has remained the preferred denture base material,to overcome have been created and introduced in dentistry the drawbacks of PMMA (1). To increase the physico-mechanical characteristics and biocompatibility of denture base acrylic resins, several changes have been tried. Polymer and monomer alterations are two major categories for these modifications.

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Polymer and monomer alterations are two types of modifications that can be found. Chemically altering polymers or adding inorganic substances and organic fibres are both options for polymer modification. Novel polymers with increased impact strength and fatigue resistance have been developed thanks to advancements in polymer science. Rubber (2) and fibers (3) on the other hand, are used as reinforcing fillers in HC-PMMA. Not only do polymers increase mechanical qualities, but they can also have an impact on dimensional correctness and stability.

Comment [D6]: Other than these, which are the modifications? Mention them.

Chemically modified monomers with strong cytocompatibility have been popular in recent years.It has been developed to have excellent dimensional precision and increased strength. In comparison to polymeric alterations, there are just a few studies on monomer modifications. Fluoromonomers, phosphate monomers, methacrylic acid monomer, itaconate monomers, nitro-monomers, and other nonspecific monomers were substituted with MMA to study the physico-mechanical properties of HC denture base resins.A volume replacement of MMA at various doses was used to modify monomers. Except for methacrylic acid monomer, none of the above monomers have been copolymerized or chemically characterised in the dental literature (4)

Even though these components have been in use in dentistry for a long time they do have effects on the oral mucosa. Symptoms such as stomatodynia, glossodynia, rubor, and mucosal erosion are frequently described as oral responses to denture base acrylic resins . The monomer to polymer conversion is not complete in free-radical polymerization, and the unreacted residual monomer released from the denture base may produce discomfort or allergic oral reactions when it comes into contact with the oral mucosa (5,6).

This survey tries to determine the level of knowledge and awareness on the allergies caused due to residual monomer and modification of monomers. Our department has already published considerable research on a variety of prosthetic dental topics. (7–17), This extensive research background has prompted us to investigate dental students' knowledge of the uses of these modified monomers in acrylic denture base resin.

MATERIALS AND METHODS

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Study Setting

The Institutional Ethics Committee gave its clearance to the study [SDC/SIHEC/2020/DIASDATA/0619-0320]. One reviewer, one assessor, and one guide were involved in the research.

Study Design

All students in years I, II, III, and IV BDS, as well as interns and post-graduates, were invited to participate in the study.

Sampling Technique

A non-probability consecutive sampling strategy was used in the investigation. All replies were evaluated and incorporated to reduce sample bias.

Data Collection and Tabulation

The poll was performed using Google Forms, an online platform. All data were included to reduce sampling bias. The data was taken from Google Forms and imported into Excel, where it was tabulated. The data was tallied and analysed.

RESULTS AND DISCUSSION

The survey involved 120 students, and the data were gathered and examined. 44.2 % of the 120 participants were III BDS, 26.7% were IV BDS and 29.2% were interns. [Figure 1]. [Figure 2] represents the knowledge of undergraduate students about allergic symptoms that are associated with the use of denture base in the oral cavity. [Figure 3] represents the knowledge of undergraduate students about the most common and frequently reported problem with patients

Comment [D8]: What about the 1st and 2nd year students?

having allergic reactions to denture base acrylic resin. [Figure 4] represents the knowledge of undergraduate students about what mainly causes the cytotoxic effects due to the use of denture base acrylic resins. [Figure 5] represents the knowledge of undergraduate students about represents the knowledge of undergraduate students about which type of curing method of acrylic resins leaches out higher quantities of residual monomer. [Figure 6] represents the knowledge of undergraduate students about if polymerization temperature has an effect on the cytotoxic effect caused by monomers in the oral cavity. [Figure 7] represents the knowledge of undergraduate students about if polymerization time is extended, will the amount of residual unreacted monomer also get reduced. [Figure 8] represents the knowledge of undergraduate students about which areas of the oral cavity are affected frequently due to monomer allergy. [Figure 9] represents the knowledge of undergraduate students about if they know the reason behind why dentures should be placed in water in the first 24 h after fabrication. [Figure 10] represents the knowledge of undergraduate students about which of the following are allergic free denture components. [Figure 11] represents the knowledge of undergraduate students about if the statement, Specimens polymerized by conventional methods exhibited slightly higher concentrations of residual monomer compared with specimens polymerized by microwave irradiation is true or not. [Figure 12] represents the knowledge of undergraduate students about which among the following pictures depicts contact allergy caused due to monomer leaching from denture base [Img 1] [Img 2]. [Figure 13] represents the knowledge of undergraduate students about if monomer modification will aid with better structural, biological and functionally better dentures. [Figure 14] represents the knowledge of undergraduate students about which of the following are examples of modifications made to components of monomer.

For the question which allergic symptoms are associated with the use of denture base in the oral cavity, the most common symptom chosen was stomatitis which included about 90.8% of the study population. For the question which is the most common and frequently reported problem with patients having allergic reactions to denture base acrylic resin the answer was burning sensation which include about 47.5%. For the question what mainly causes the cytotoxic effects due to the use of denture base acrylic resins the most common answer chosen was the ~~L~~leaching out of monomeric components during the conversion of MMA to PMMA (18). For the question which type of curing method of acrylic resins leaches out higher quantities of residual monomer, about 60% of the study population said it was heat-cured denture base resins but studies have shown that self-cured/auto-polymerized leaches out higher quantities of residual monomer during curing ~~(~~(18,19)(20). The polymerization reaction (curing process) converts monomer molecules into polymers, resulting in the conversion of MMA into poly-MMA. Not all monomer molecules are transformed during this process, therefore some unreacted residual monomers remain unpolymerized (21) The unreacted monomer may seep into the saliva, resulting in cytotoxic consequences in the oral cavity. (22) The negative consequences will be larger as the amount of unreacted monomer increases. For the question does polymerization temperature have an effect on the cytotoxic effect caused by monomers in the oral cavity, about 72.5% of the study population agreed that temperature does have an effect on the cytotoxic effect. For the question if polymerization time is extended, the amount of residual unreacted monomer is reduced, about 58.3% of the study population responded by saying that the statement is true. When the polymerization period is increased, the amount of unreacted monomer remains much lower, lowering the risk of cytotoxicity. A 7-hour incubation in water at 70°C followed by a 1-hour incubation in water at 100°C is recommended for maximal monomer conversion (23) It is

recommended that the heat-cured denture bases be stored in water for 1–2 days before being administered to patients, and that boiling during the polymerization stage be done for at least 30 minutes at maximum temperatures. This is intended to significantly lessen the cytotoxic effects produced by residual monomer (18). The amount of residual monomer content in self-cured denture bases that are also polymerized in water at 60°C and maintained in water at room temperature for one day shows a considerable reduction (24). For the question, what are the areas of the oral cavity that are affected frequently due to monomer allergy? About 66.7% said oropharynx and 64.2% said palate and tongue (25)(26). For the question of the main reason dentures should be placed in water in the first 24 h after fabrication, about 61.7% of the population responded by saying that it is to allow the unreacted monomeric materials to seep into the water. (27). For the question of what are some of the allergic free denture base components that can be used, about 62.5% of the study population said metal denture base and about 63.5% said Valplast(4). For the statement specimens polymerized by conventional methods exhibited slightly higher concentrations of residual monomer compared with specimens polymerized by microwave irradiation, about 70% of the population said that the statement was true. When the cytotoxic effects of microwave cured acrylic resins were investigated, it was discovered that 20 minutes of polymerization utilising microwave irradiation resulted in much lower residual monomer content than when alternative polymerization methods were used (28)(29)This decrease in monomer content after employing the microwave method of polymerization could be crucial in reducing the material's harmful consequences (30). For the question among the following pictures which one depicts contact allergy caused due to monomer leaching from the denture base, the first image depicting allergic stomatitis and the second image depicting denture stomatitis, about 77.5% of the study population chose the first image. For the question can

components of monomers be modified to aid with better structural, biological and functionally better dentures about 79.2% of the study population responded saying yes it can. For the question which of the following are examples of modifications made to components of monomer about 78.3% said it is phosphate monomer, 72.5% said fluromonomers and 60% said dimethylammoniumethyldimethacrylate(31).

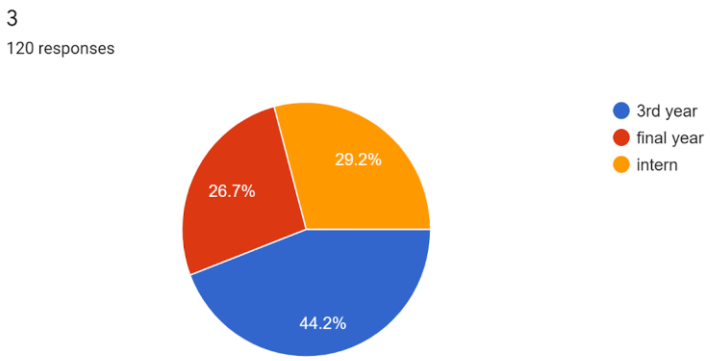

Figure 1: This pie chart depicts the demographics of the research participants, with blue denoting 3rd year students, red denoting final year students and orange denoting interns. 26.7% of the study population fall into the final year category, 29.2% of the study population fall into the intern category and 44.2% study population fall into the 3rd year category.

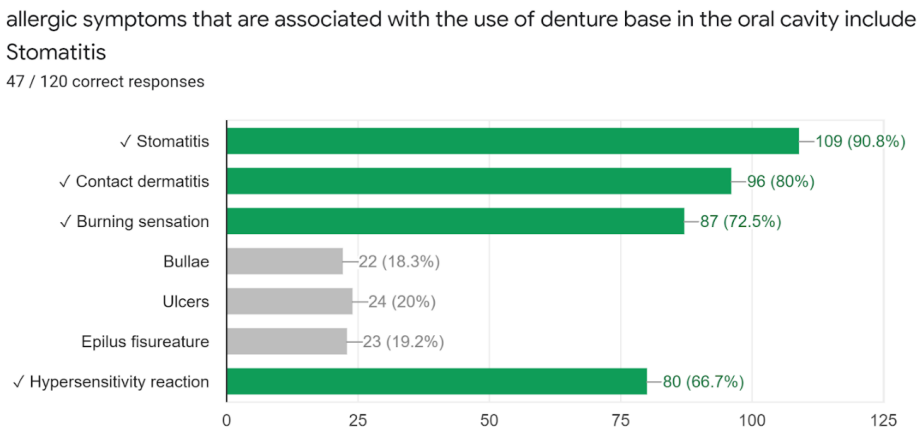

Figure 2: This bar chart depicts the response to the question which allergic symptoms are associated with the use of denture base in the oral cavity. 90.8% of the respondents said stomatitis, 80% of the respondents said contact dermatitis, 72.5% of the respondents said burning sensation, 18.3% said bullae, 20% said ulcers, 19.2% said epilus fisureature and 19.2% said hypersensitivity reaction.

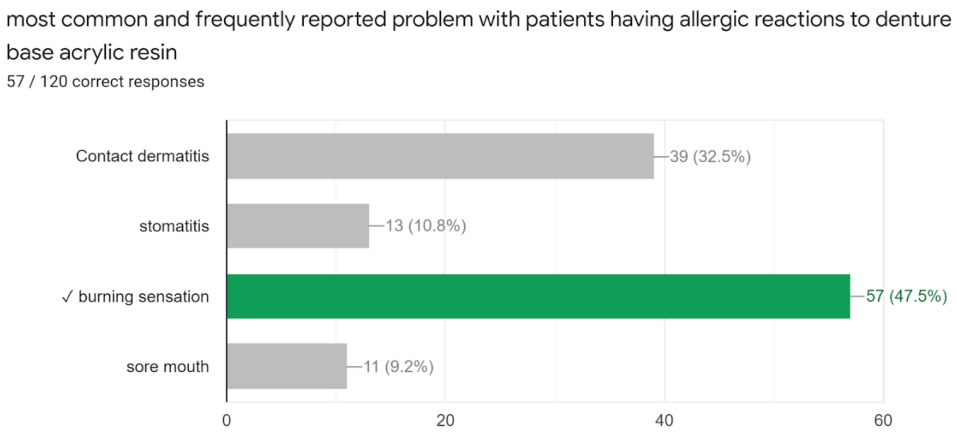

Figure 3: This bar chart depicts the response to the question which is the most common and frequently reported problem with patients having allergic reaction to denture base acrylic resin. 32.5% of the respondents said contact dermatitis, 10.8% of the respondents said stomatitis, 47.5% of the respondents said burning sensation and 9.2% of the respondents said sore mouth .

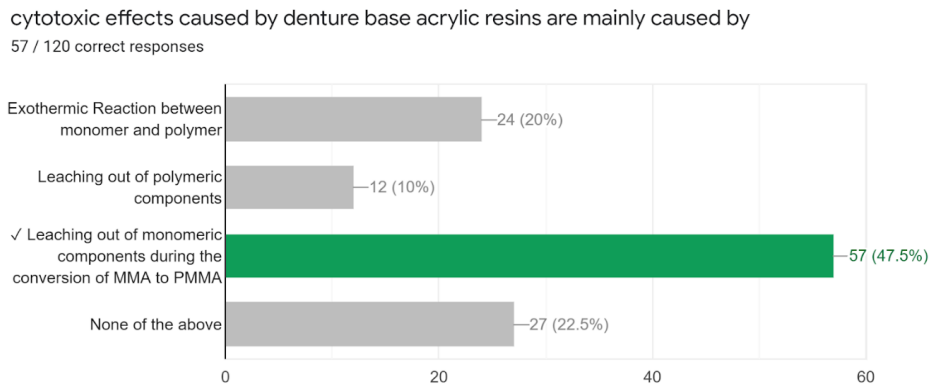

Figure 4: This bar chart depicts the response to the question the cytotoxic effects caused by the denture base acrylic resins are mainly caused by , about 20% of the respondents said it~~s~~ was due the Exothermic Reaction between monomer and polymer, 10% of the respondents said it was due to the Leaching out of polymeric components, 47.5% of the respondents said it was due to Leaching out of monomeric components during the conversion of MMA to PMMA and 22.5% of the respondents said none of the above.

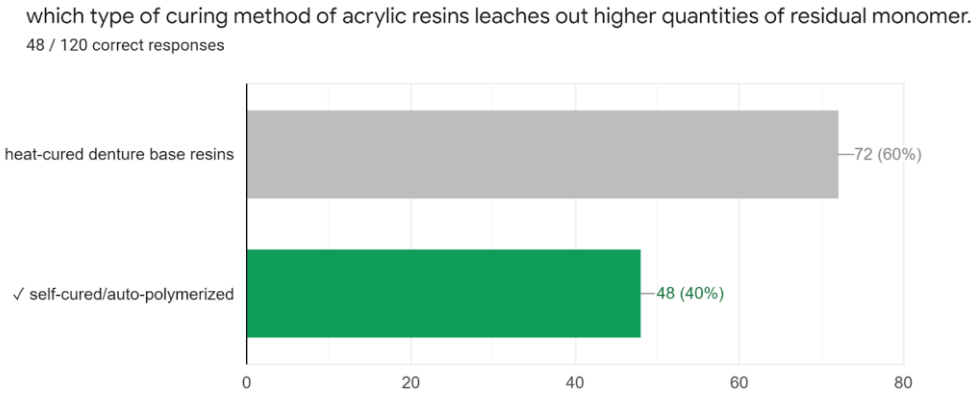

Figure 5: This bar chart depicts the response to the question which type of curing method of acrylic resins leaches out higher quantities of residual monomer. About 60% of the respondents said heat-cured denture base resins whereas about 40% of the respondents said self-cured/auto-polymerized resin .

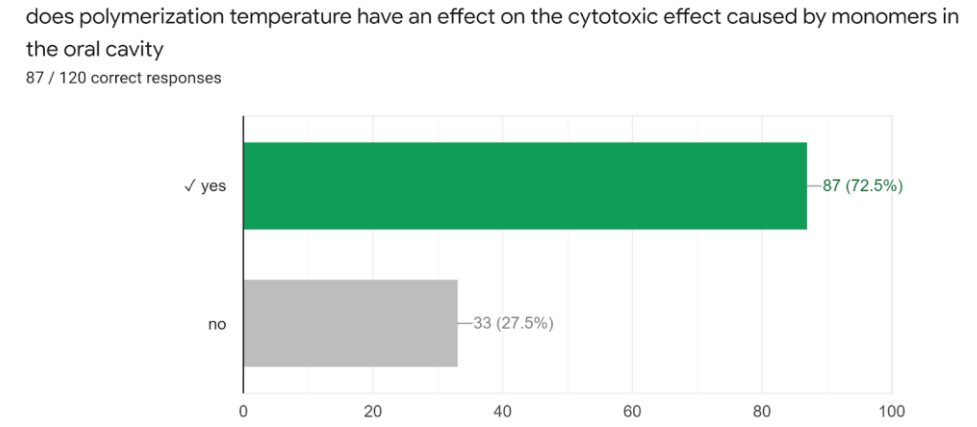

Figure 6: This bar chart depicts the response to the question, does polymerization temperature have an effect on the cytotoxic effect caused by monomers in the oral cavity . About 72.5% of the respondents said yes whereas about 27.5% of the respondents said no.

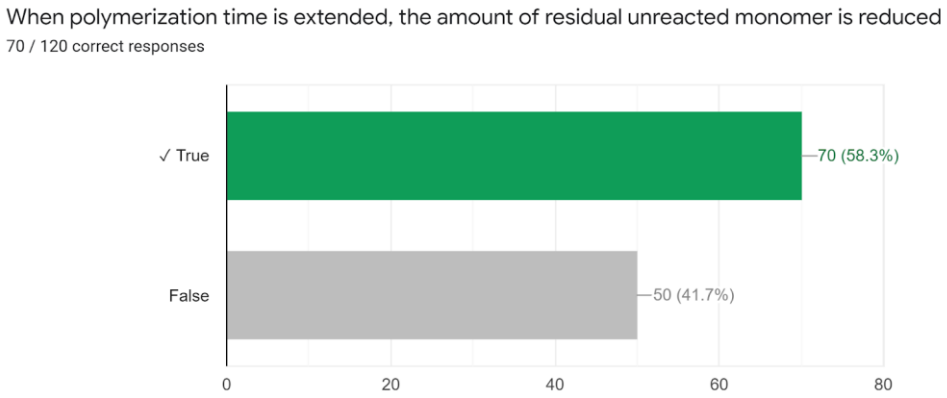

Figure 7: This bar chart depicts the response to the question that if the polymerization time is extended , will the amount of residual unreacted monomer be reduced. About 58.3% of the respondents agreed that the statement was true whereas about 41.7% of the respondents said the statement was false.

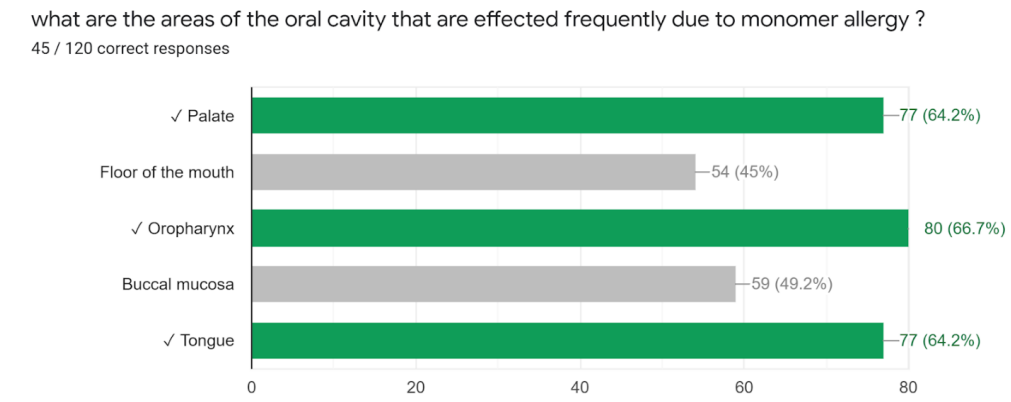

Figure 8: This bar chart depicts the response to the question what are the areas of the oral cavity that are affected frequently due to monomer allergy. 64.2% of the respondents said palate, 45% of the respondents said floor of the mouth , 66.7% of the respondents said oropharynx , 49.2% said buccal mucosa, 64.2% said tongue.

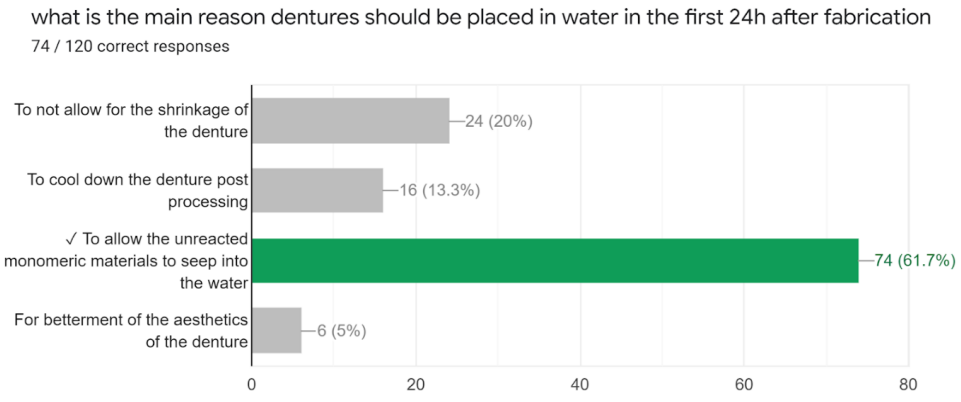

Figure 9: This bar chart depicts the response to the question, what is the main reason dentures should be placed in water in the 1st 24h after fabrication. 20% of the respondents said it was to

not allow for the shrinkage of the denture, 13.3% of the respondents said it was to cool down the denture post processing , 61.7% said it was to allow the unreacted monomeric materials to seep into the water and 5% said it was for betterment of the aesthetics of the denture.

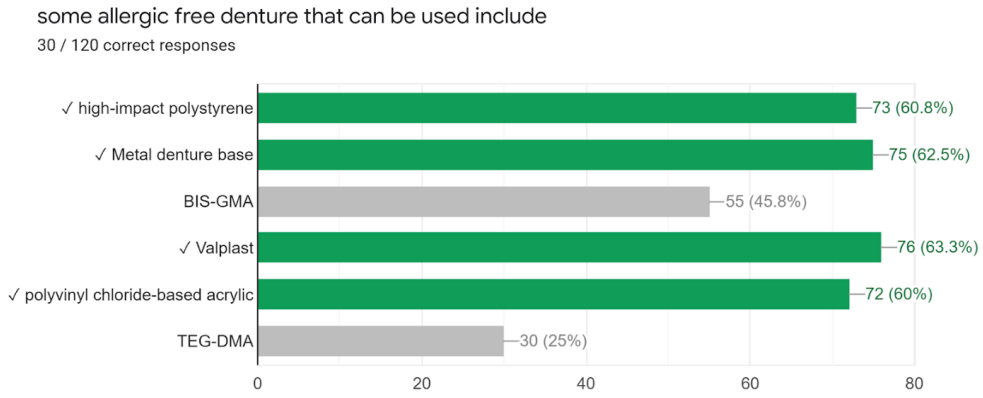

Figure 10: This bar chart depicts the response to the questions which are some of the common allergic free denture base materials that can be used, about 60.8% of the respondents said high-impact polystyrene , 62.5% said metal senture base , 45.8% said BIS-GMA , 63.3% said Valplast, polyvinyl chloride-based acrylic material, and 25% said TEG-DMA .

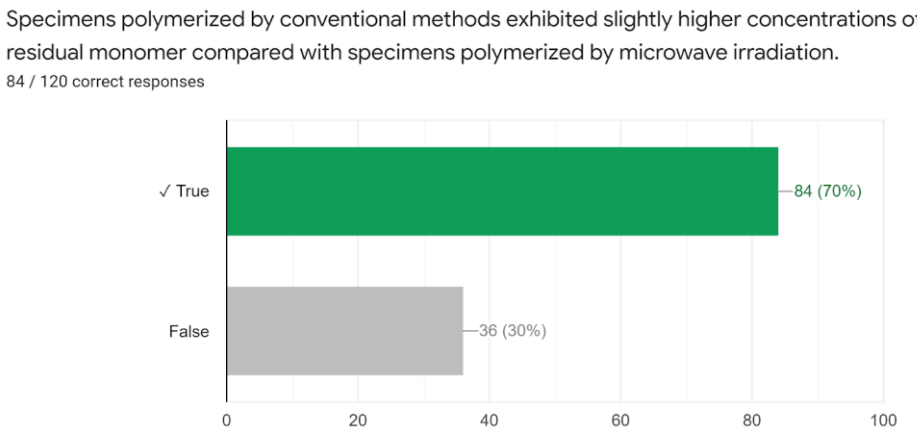

Figure 11: This bar chart depicts the response to if the statement, specimens polymerized by conventional method exhibited slightly high concentrations of residual monomer compared with specimens polymerized by microwave irradiation, about 70% of the respondents said that the statement was true whereas 30% said that the statement was false.

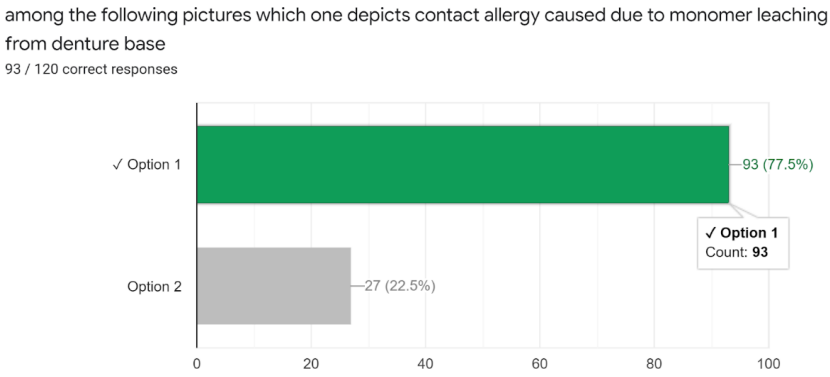

Image 1 Image 2

Figure 12: This bar chart depicts the response to the question which of the following images depicts contact allergy caused due to monomer leaching from the denture base. Image one ~~impage one~~ depicts an image of contact allergy whereas image 2 depicts an image of denture stomatitis. About 77.5% of the respondents choose the first image were as about 22.5% choose the second image.

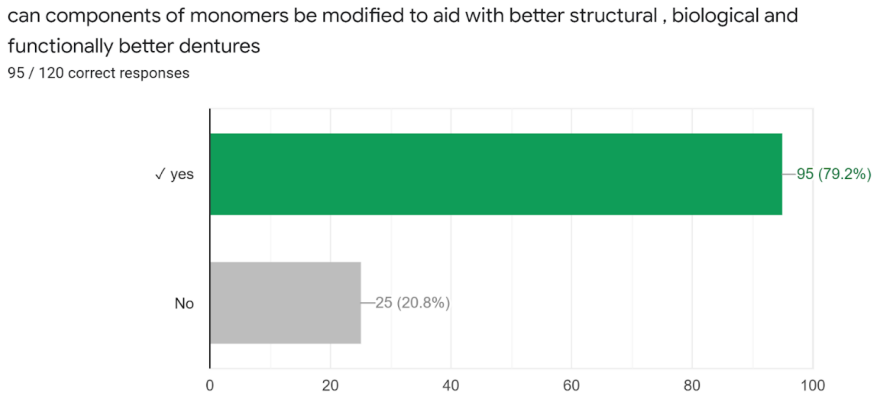

Figure 13: This bar chart depicts the response to the question, can components of monomers be modified to aid with better structural, biological and functionally better dentures. About 79.2% of the respondents said yes whereas about 20.8% of the respondents said no.

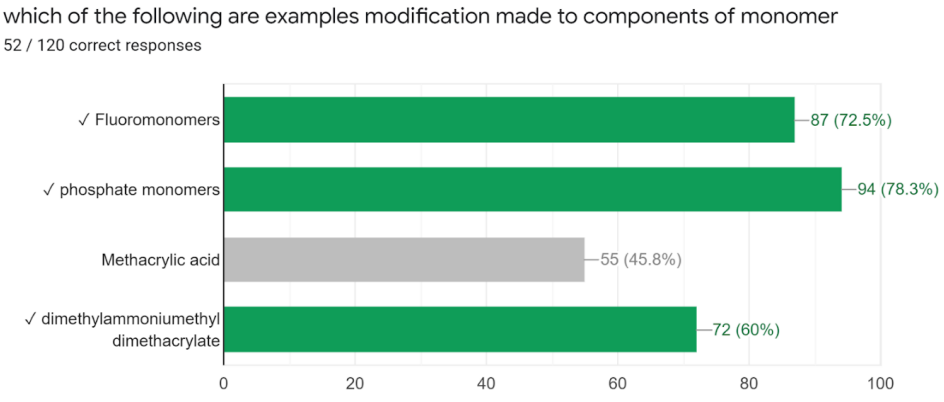

Figure 14: This bar chart depicts the response to the question, which of the following are examples of modification made to components of monomer 72.5% of the respondents said

fluromonomers, 78.3% said phosphate monomers, 45.8% said methacrylic acid and 60% said dimethylammonimethlydimethacrylate.

CONCLUSION

The survey helped the students to understand the various modifications in monomers and allergies that can be caused due to monomers for making a denture base. They got to know the various uses of each modification and the impact of that modification in the physical and chemical integrity of the denture base and the biological effects that these modifications can have. It was evident that students did have a well rounded understanding about monomer modifications and the effects they can have in the oral cavity, but more information about these facts in their curriculum would assist students in expanding their knowledge and manipulating the content in order to become more versatile with these materials.

Comment [D9]: A lopsided conclusion was made. The main theme of the manuscript is absent overall. It needs rearrangement.

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