Toxic Biological Effects Associated with Materials Used in Prosthodontics- A Survey

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Abstract

Prosthodontics practice involves contact with restorative materials, auxiliary dental materials which are broadly of different composition. The leakage and transfer of the potent allergic components from these materials is the cause of hypersensitive reactions to patients, dental professionals and the lab technicians. The biological side-effects of the materials that are in dental practice are rare. All artificial materials release substances in the oral environment which are potent allergens that might cause side effects and adverse reactions. The current study gives a statically about the dental professional knowledge and also makes the aware of toxic biological side effects of these materials, also make them aware of the reporting of the cases. A cross sectional survey was conducted among 100 dental professionals about the Toxic Biological effects associated with materials used in prosthodontics. Questionnaires with 20 close ended questions were circulated among people. Results obtained analyzed using SPSS software.In this Study, almost 80% of them were aware that some components of the dental materials might cause a hypersensitivity reaction. 57% of the participants have not experienced any allergic resin, latex, gloves etc.The prevalence of allergic reaction among Dental staff is low and most reported are due to latex, acrylate & formaldehyde. The present study shows that there is a lack of knowledge on the toxic biological effects of dental material used in prosthodontics.

Keywords: *Adverse effects; Awareness; Dental materials; Occupational hazards; Prosthodontics; Side effects; Toxic biological effects.*

Introduction

The smile is a key segment to the confidence of a person. At times, from a clinical viewpoint, it appears that ideas of denture aesthetics are being covered by mechanistic concerns for denture stability and capacity. The job of a prosthodontist is to advance oral health and dental aesthetics[12]. The ADA has defined prosthodontics as "the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation, and maintenance of oral function, comfort, appearance, and health of patients with clinical conditions associated with missing or deficient teeth and/or oral and maxillofacial tissues using biocompatible substitutes."[3].Prosthodontics is an important aspect of dentistry. Prosthodontics usually deals with dentures, dental implants, oral and facial prostheses to provide solutions for the different dental issues experienced by patients.[45] Prosthodontists specialist aim to reestablish the appearance, speech , and swallowing capacity of the patients back to typical subsequent to being affected by an injury or infected condition [67]. Prosthodontics practice involves contact with restorative materials, auxiliary dental materials which are broadly of different composition. Regardless of the kind of medical procedure, there are advantages, dangers, and symptoms that might occur.[8] With dental prosthesis, the chances of issues are rather low, but

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there are still complications that can emerge [9,10] .The leakage and transfer of the potent allergic components from these materials is the cause of hypersensitive reactions to patients, dental professionals and the lab technicians.[11,1213]

An allergy is a disorder in which the body becomes hypersensitive to particular antigens which bring about characteristic manifestation whenever they are subsequently inhaled, ingested, injected, or in any case contacted [14].The biological side-effects of the materials that are in dental practice are rare. All artificial materials release substances in the oral environment which are potent allergens that might cause side effects and adverse reactions[15]. The incidence of these side effects to dental material is seen in 1 per 500 patients reported [16] which is quite high and most people don't report the incidence[17] A review article that 139 published cases of allergy to just base-metal alloy in RPD dentures [18] During dental treatment, different materials are utilized which can effectively affect patients and dental staff; henceforth it is important to utilize them with alertness.

The current study gives a statically about the dental professional knowledge and also makes the aware of toxic biological side effects of these materials, also make them aware of the reporting of the cases.There are many potential hazards & problems exist but only few are documented the adverse reaction. The clinicians are made aware to report the side-effects to the higher body.This study assesses the knowledge about the toxic Biological effects associated with materials used in prosthodontics among dental professionals, students and technicians and to create awareness on the reporting of adverse effects.

Materials & Methods

A cross sectional study conducted among 100 dental professionals, Dental students and Lab technicians in Chennai through online portal 'Google forms' TThe Participants were surveyed utilizing an organized poll including 20 close finished inquiries in regards to demographic details (age, gender, occupation) adverse effects of material, materials toxicity, biocompatibility tests etc..,(Table 1).For better understanding, occupation was put into 3 groups ,Group 1 ,Group 2, and Group 3 which represents Dentist, Dental students and Dental technicians respectively. All the collected data were then analyzed through SPSS software and pie charts were plotted with extracted data. Chi square test and pearson correlation analysis were used, with p value less than 0.05 to be statistically significant.

Result & Discussion

In the present study. A total of 100 Dental professionals were questioned out of which 39 (39%) were male and 59 (71%) female. The age range of the participants were from 18-50 & above.(table 2)For better understanding, occupation was put into 3 groups ,Group 1 ,Group 2, and Group 3 which represents Dentist, Dental students and Dental technicians respectively.

Prosthodontics application requires contact with restorative & auxiliary materials of various different compositions like metals, synthetic polymers, cements, impression material, restorative material – Dental amalgam composites & ceramics.[19,20] Different materials are used in fabricating and fitting prosthodontics appliances in patients. An association between groups and their awareness on dental materials used in prosthodontics was done [Figure 1].There was no significant difference between groups and awareness on dental materials.p=0.270;Statistically not significant. However group 2 participants are more aware of dental materials used in prosthodontics.Articles say that adverse reactions that [21,22]are related with type IV hypersensitivity reactions may be elicited by prosthodontics material but other should be considered.[23]

An association between groups and their opinion on materials used in prosthodontics are potent allergens was done[Figure 2].There is no significant difference between groups and awareness on components of dental materials which are potent allergens.p=0.154;Statistically not significant. However group 2 participants are aware that components of dental materials are potent allergens .

Data from [Figure 3] shows 57% of the participants have not experienced any allergic resin, latex, gloves etc.Association between groups and their experience of allergic reaction from dental material was done [Figure 4].There is no significant difference between groups and the experience of allergic reaction to dental materials. p=0.681; Statistically not significant. However , the majority of Group 2 participants have not experienced any allergic reaction.The prevalence of allergic

reaction among Dental staff is low and most reported are due to latex, acrylate & formaldehyde. Poly methyl methacrylate in latex triggers a delayed hypersensitivity reaction and sodium metabisulphite & nickel-immediate response.[24,25]

Patients might experience reactions when skin comes in contact with the allergen or exposure to dust, inhalation of fumes etc., [26,10,27–29,30]Most potential problems are to be brought using recommended safety protective devices[31] Removable acrylic resin partial dentures will generally ominously impact periodontal parameters when teeth are in contact with resin base. This impact is expanded with longer length of RPD wear. [3233]

Frequent dermatological reactions associated with dental materials are transient redness, irritation, blisters, soreness, pain etc..[34], caused by latex gloves, resin. Eugenol cements, impression material etc.,[35,36,37]which says most of them are not aware of the reactions as all the above mentioned were given in option. And a review conducted by subashree says that aloe vera gel can be considered a safe alternative treatment for patients with OLP[38].According to a study, Non dermatological actions include damage to eyes from UV light and visible light used in everyday practice, Which also implies, there is no proper knowledge on how the reactions are seen.[36] .an association between groups and their response on hypersensitivity reaction caused by dental materials was done [Figure 5] .There is no significant difference between groups and hypersensitivity caused by dental materials.p=0.371;Statistically not significant.However majority of group 2 says type 4.

Specialists concur similar sensitivities identified with dentistry incorporate deferred Hypersensitivity responses to explicitly include delayed Hypersensitivity reactions to specific Dental materials, true allergic reaction is uncommon[39]

Resins contain cadmium salt as a coloring agent along with other agents [10,27,28]. This poses a potential hazard to the technician while they routinely grind, finishing prosthesis made resin based materials.[40,41]Some metals used in dental alloys are biologically active & are potential hazard, includes nickel, chromium, cobalt, cadmium, beryllium [1810,27–29] most common clinical symptoms – gingivitis, stomatitis almost 25% of patient[42].Study also says eugenol is a known cytotoxic and allergic substance that causes irritation to tissues.[43]

Many preclinical biocompatibility tests are available to minimize risk test categorized basis on applicability levels primary cell culture test, hemolytic test etc., Secondary tests – implementation test, skin irritation test etc..,[45]An association between groups and their awareness on preclinical tests that are available to minimise the risk of adverse effects to dental materials among the participants[Figure 6].There is no significant difference between groups and awareness on preclinical tests.p=0.415; Statistically not significant . However , Group 2 is aware of preclinical tests more than others.

Table 1: Questionnaire of the survey

1	Age	18-30 30-50 50 and above
2	Gender	Male Female
3	Occupation	Dental Student Dentist Dental Technician
4	Prosthodontics deals with a lot of materials like resin polymer, Impression materials etc..,	Yes No

Cont... **Table 1: Questionnaire of the survey**

5	Are you aware that more than 75% of all existing dental materials are directly or indirectly used in fabricating and providing prosthodontics restoration?	Yes No
6	Some components in these might have potent allergen or leak and cause a hypersensitivity reaction	Yes No
7	Have you ever experienced any allergic reaction from the dental materials? Like acrylic resins, latex gloves, impression materials etc.,	Yes No
8	Did any of your patients / co-worker have an allergic reaction to the dental materials?	Yes No
9	Patient might experience adverse effects due to	-Contact with skin -Exposure to dust from miking, grinding, polishing -Inhalation of fumes and vapors -None of the above
10	What do you think are frequent dermatological reactions seen in hypersensitivity to materials	-transient redness -irritation -pain -None of the above
11	Non dermatological reactions includes	-damage to eyes -Respiratory reactions -others -None
12	What type of hypersensitivity reactions is more common to prosthodontics materials?	Type 1 Type 2 Type 3 Type 4
13	Studies say that 1 out of 300 patients are experiencing adverse effects reaction	Yes No way
14	Are you aware that component of polymer resin-cadmium salts is a potential hazards to the dental technicians	Yes No
15	Which metals do you think might cause an allergic reaction	Chromium Cobalt nickel Gold Nickel titanium None

Cont... **Table 1: Questionnaire of the survey**

16	Eugenol is	Cytotoxic Allergic substance Both A & B None
17	Are you aware of preclinical tests that are a available to minimize the risk of adverse effects to dental materials	Yes No
18	What do you think can be done to reduce these adverse effects	
19	Did you report the hypersensitivity reaction occurred to you or patient to certifying bodies ?	Yes No
20	Was this survey helpful	Yes No

Table 2 : Demographic details of the study participants .(n=100)

Characteristics	**Frequencies,(n%)**
Age category(years) 18-30 30-50 50 and above	 68(68%) 22 (22%) 30 (30%)
Gender Male Female	 59 (59%) 39 (39%)

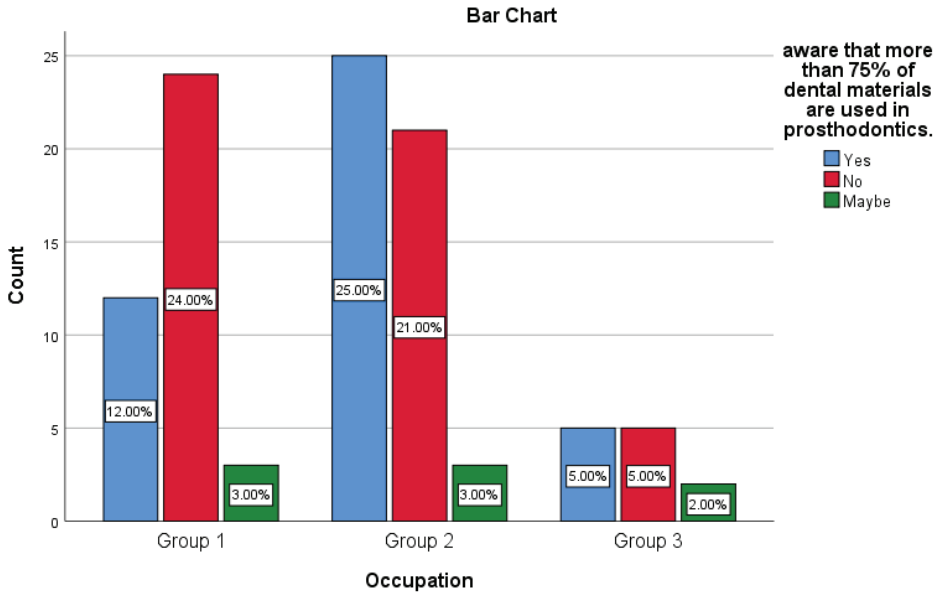

Figure 1. Bar chart showing association between groups and their awareness on dental materials used in prosthodontics. X-axis represents the groups and Y- represents the number of responses .Where blue, red and green bars denote yes, no and may be respectively. There is no significant difference between groups and awareness on dental materials. Chi square test was done ;p=0.270;p value>0.05, Statistically not significant. However group 2 participants are aware of dental materials used in prosthodontics.

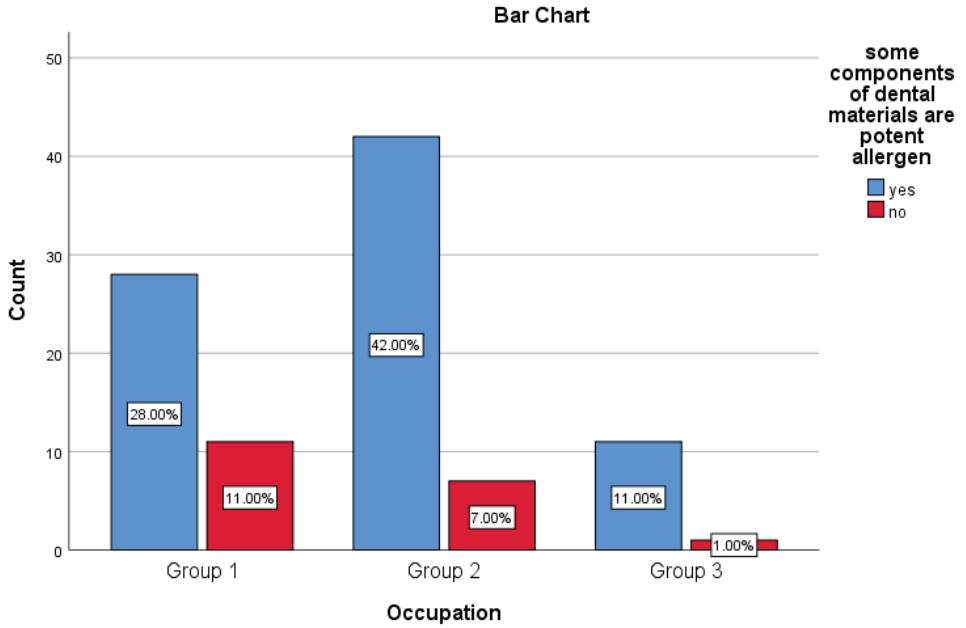

Figure 2.Bar chart depicts the association between groups and their opinion on materials used in prosthodontics are potent allergens. X-axis represents the groups and Y-axis represents the number of responses, where blue and red bars denote yes and no respectively. There is no significant difference between groups and awareness on components of dental materials which are potent allergens.chi square test was done;p=0.154;p value>0.05 Statistically not significant. However group 2 participants are aware that components of dental materials are potent allergens .

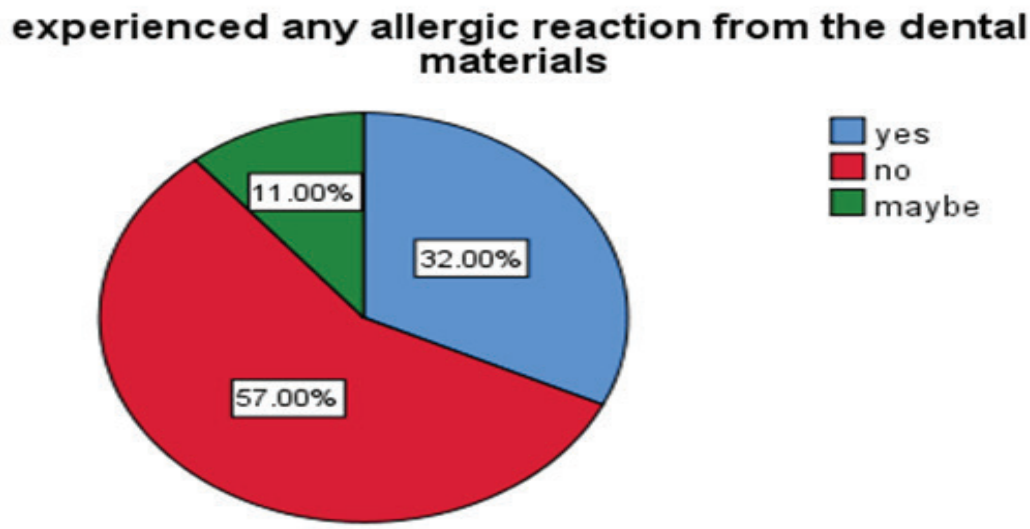

Figure 3. The pie chart shows the response to the question " experience of allergic reaction from dental material".32% said they have experience , while majority (57%) have not. Majority of them haven't experienced adverse reactions to dental materials.

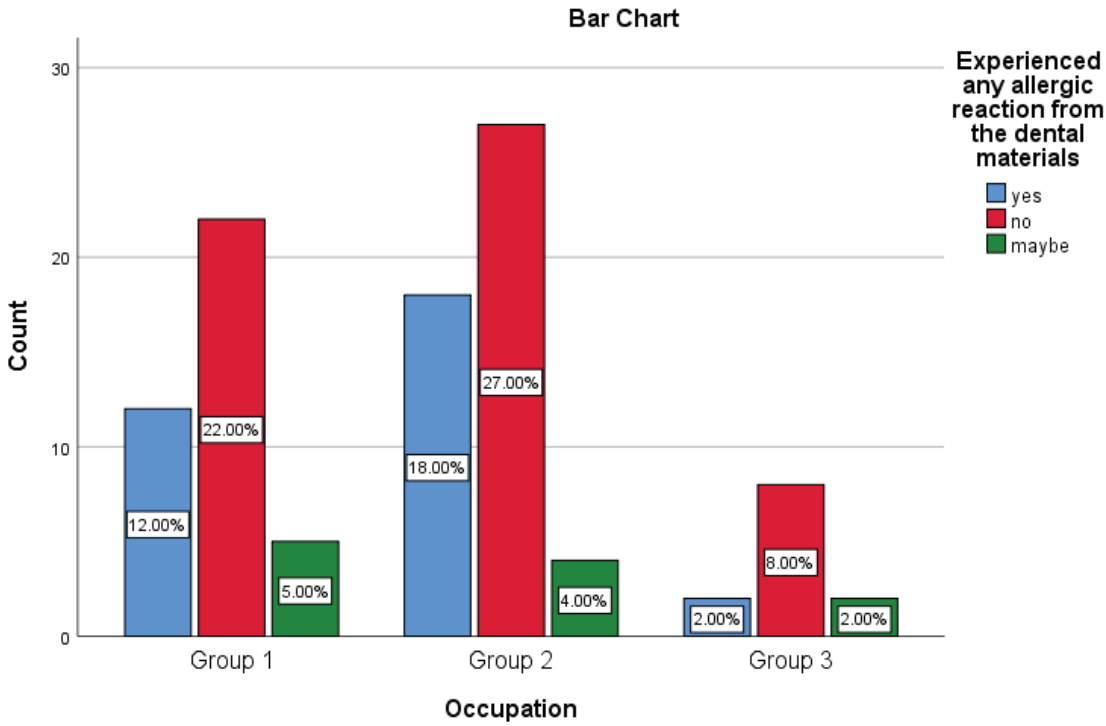

Figure 4.groups Bar chart showing association between groups and their experience of allergic reaction from dental material.X-axis represents the groups and Y-axis represents the no. Of response where blue, red and green bars denote yes, no, and may be respectively.There is no significant difference between groups and the experience of allergic reaction to dental materials.chi square test was done ;p=0.681;p value>0.05 Statistically not significant. However , the majority of Group 2 participants have not experienced any allergic reaction.

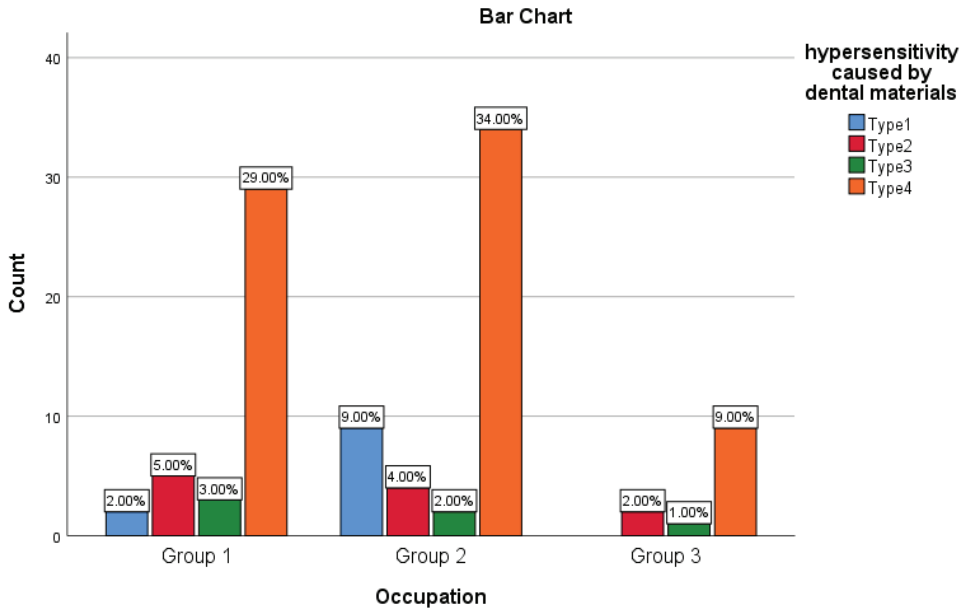

Figure 5.Bar chart showing association between groups and their response on hypersensitivity reaction caused by dental materials.X-axis represents the groups and Y-axis represents the no. Of response where blue,red,green,and orange denote Type1, Type 2, Type 3 and Type 4 respectively.There is no significant difference between groups and hypersensitivity caused by dental materials.chi square test was done;p=0.371;p value>0.05 Statistically not significant.However majority of group 2 says type 4.

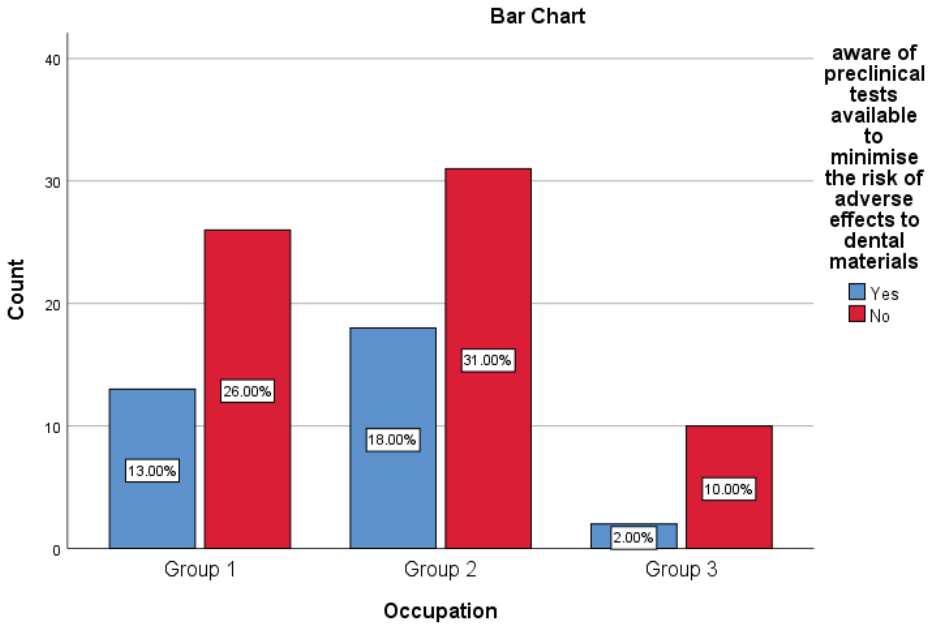

Figure 6.Bar chart showing association between groups and their awareness on preclinical tests that are available to minimise the risk of adverse effects to dental materials among the participants. X-axis represents the groups and Y-axis represents the no. Of response ,where blue and red bars denote yes and no respectively. .There is no significant difference between groups and awareness on preclinical tests.chi square test was done ;p=0.415;p value>0.05 Statistically not significant . However , Group 2 is aware of preclinical tests more than others.

The study was taken in a small population where there was difference in opinion, language communication or resource problems. The actual numbers of respondents are low compared to the total number of dental professionals and therefore might not be representative of the entire group. This study might be helpful in other similar studies.More surveys should be taken on this field so that we can assess people's awareness and knowledge on different places.

Conclusion

From the study, it can be concluded that the majority of dental professionals lack knowledge about the toxic biological effects associated with dental materials used in prosthodontics. The study also shows that dental students are more aware about dental materials and it's biohazard than dentists and dental technicians. Proper education & conferences should be conducted among the dental professionals to create awareness on the toxic effects of the dental materials.

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