

Awareness of Dental Practitioners Regarding Biocompatibility of Dental Materials

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ABSTRACT

Objective: This study was done to evaluate awareness of dental practitioners regarding biocompatibility of dental materials among dental practitioners.

Study Design: Cross sectional study

Place and duration of study: This study was conducted in Islamic international dental college Islamabad during June 2019 to December 2019.

Materials and methods: This was a cross sectional questionnaire based study. Questionnaires were distributed to house officers and post graduate trainees (N=100) of Islamic International Dental Hospital. The recorded data was analyzed using SPSS2015 (version 23) software.

Results: 85% of dental practitioners had knowledge about biocompatibility of polymer based materials. 89% were aware of type of adverse reactions associated with latex gloves. 64% of dental practitioners had awareness that eugenol is a cytotoxic substance present in zinc oxide eugenol. 7% of dental practitioners knew about the various methods to diagnose titanium allergy.

Practical implication: This study will help the dental practitioners to comprehend what type of allergies are prevalent in their local population and which dental material can give best results without adverse effects.

Conclusion: Our participants have sufficient knowledge about the biocompatibility of dental materials but the knowledge about titanium allergy needs to be enhanced.

Keywords: awareness, biocompatibility, dental practitioners, dental materials

INTRODUCTION

Biocompatibility is the ability of a material to provide a desired function with harmony to the environment in which it is placed¹. A large number of materials including restorative materials, endodontic materials, alloys, base metals etc are used in dentistry for different purposes². The success or failure of these materials depends on several factors, one of which is biocompatibility, which is determined by the corrosion of that material³. The more corrosion resistant a material is, the more biocompatible it is, and the less will be the chance for it to cause an allergic reaction or any severe adverse effect.

The adverse effects range from mild localized allergic response to life threatening anaphylaxis. With some materials, the risk of developing an adverse effect is many folds higher to the practitioner or technician than the patient, such as hand and fingertip reactions¹. Adverse reaction reported in dental staff are dry, cracking and flaking skin, hand and fingertip reaction, irritation, swelling and generalized neuropathy after 14 years exposure to methacrylates⁴. Allergic response to titanium used for dental implants has also been reported in 0.6 to 5% dental patients⁵. Likewise, allergic response to latex gloves, eugenol, rosin, platinum, gold, acrylic etc are reported by many patients. Among these the most commonly reported is the immediate type allergy to latex, rubber additives, acrylates and local anaesthetics⁶⁻⁸.

As more sophisticated tools for assessing cellular and subcellular responses become available and as new materials and repair techniques become available, the problems that need to be solved and the methods that need to be used may shift⁹. Furthermore, the biocompatibility of these materials needs to be the dentist's key consideration before using them, as dental technology is changing rapidly and new materials are being introduced to the market on a regular basis¹⁰. While many dentists might not see why they should spend time learning the specifics of biocompatibility, it is crucial that they do so for the sake of their patients, their staff (including lab workers), and their own health.

In order to evaluate the claims made in ads and to ask the right questions of manufacturers, practitioners need have a solid understanding of the processes used to test biocompatibility. Dentists who want to use a material in the clinic must weigh the benefits and drawbacks of employing the material before making a

decision to do so, as there is no fool proof method for determining how the body will react to a substance.

and they must be equipped with the relevant knowledge regarding the material's biocompatibility to undertake appropriate selection of materials and hence ensure patient safety¹¹. This relevant knowledge will depend upon how much the dentists are concerned with biocompatibility and patient safety and how up to date they are with the research advances regarding these.

When comparing the amount of dental treatments done with the reported cases of allergic reactions to dental treatment and dental drugs, the figure is quite low⁶⁻⁸. In order to overcome this underreporting issue there is a dire need of continuous improvement of awareness among the dentists about the presence of reporting the adverse reactions³.

This cross-sectional questionnaire-based study aims to evaluate awareness of dental practitioners regarding biocompatibility of dental materials, both the newly graduated house officers and the more experienced, post graduate trainees. Also, to assess whether there is a subjective need of increasing the awareness regarding biocompatibility and reviewing research articles.

METHODOLOGY

A questionnaire-based cross-sectional study was done at Islamic international dental hospital during June 2019 to Dec 2019. A total sample size of 100 was calculated. The sample size was calculated using the WHO calculator. In order to calculate a difference of 0.04 between the population, at a significance level of 0.05 keeping the power of the calculation at 90%, approved by the ethical committee of Institutes Review Board (IRB) of Riphah International University. The data collection was carried by random convenient method from house officers and post graduate trainees of Islamic International Dental Hospital. Prior consent was taken from the participants of the study. A new questionnaire was designed using various scientific articles. Questionnaire validation was assessed by a group of faculty members and general dentists in the field and suggestions regarding content, relevance and number of questions, choice of answers for each question, language and simplicity of the questionnaire were incorporated in the final questionnaire. The gathered data was analysed in SPSS2015 (version 23) software.

RESULTS

The results obtained after the calculations are as follows:

Table 1:

Questions	Awareness	Unawareness
Aware of allergic reactions to polymer-based materials	85%	15%
Dental practitioners ask patients if they are allergic to any kind of metal prior to a procedure	68%	32%
Dental practitioners were aware that there are possible alternatives to the allergy causing materials used in treatment	90%	10%
Dental practitioners prescribe medication if their patients suffer from adverse reactions.	69%	31%
Dental surgeons were aware of type of adverse reactions associated with latex gloves	89%	11%
Dental practitioners knew that using 30% of hydrogen peroxide is cytotoxic	67%	33%
Dental practitioners came across patients with titanium allergy	5%	95%
Dental practitioners knew about the various methods to diagnose titanium allergy	7%	93%
Dental practitioners knew that itching is the most common symptom of titanium allergy.	15%	85%
Dental practitioners were aware of exact cause of why protective layer of any other cement is applied below zinc phosphate cement in deep cavities	80%	20%
Dental practitioners have awareness that eugenol present in zinc oxide eugenol is a cytotoxic and allergic substance.	64%	36%
Dental practitioners were aware that heat generated during obturation is related to deleterious effects of gutta percha on periodontal tissues.	52%	48%

Among dental practitioners, 85% were aware of allergic reactions to polymer-based materials including ulcers and swelling while 68% of dental practitioners ask patients if they are allergic to any kind of metal prior to a procedure. It was also found that 90% of dental practitioners were aware that there are possible alternatives to the allergy causing materials used in treatment while 69% of dental practitioners prescribe medication if their patients suffer from adverse reactions.

89% of the dental surgeons were aware of type of adverse reactions associated with latex gloves while 67% of dental practitioners knew that using 30% of hydrogen peroxide is cytotoxic.

It was also seen that 5% of dental practitioners came across patients with titanium allergy while 95% had never come across patients with titanium allergy. It was found that 7% of dental practitioners knew about the various methods to diagnose titanium allergy while 15% of dental practitioners knew that itching is the most common symptom of titanium allergy.

80% of dental practitioners were aware of exact cause of why protective layer of any other cement is applied below zinc phosphate cement in deep cavities while 64% of dental practitioners have awareness that eugenol present in zinc oxide eugenol is a cytotoxic and allergic substance. 52% of dental practitioners were aware that heat generated during obturation is related to deleterious effects of gutta percha on periodontal tissues.

The level of awareness among dental practitioners about biocompatibility of dental materials is shown in the following graph.

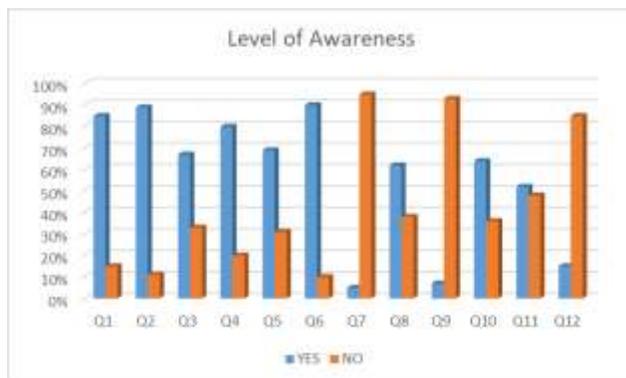


Figure 1:

DISCUSSION

Since exposure to dental materials can precipitate allergic reactions in both dentists and patients, our study was done to assess awareness of dentists about biocompatibility of some more commonly used dental materials.

Latex appears to be one of the most commonly reported allergies in dentistry¹². This allergy is a consequence of histamine release and often just causes dermatitis^{13, 14}. More severe reactions can present as respiratory difficulty, asthma and anaphylactic shock¹⁵⁻¹⁷. These reactions can be managed with antihistamines, aminophylline and in complicated cases, corticosteroids¹³⁻¹⁵. Our study showed that eighty-nine percent of the dental practitioners were aware about the adverse reactions associated with latex gloves.

The gums and jawbone around the teeth can be irritated by gutta-percha if it is administered while overly hot. Extremely dangerous, as it can cause irreparable damage to the gum tissues, is a temperature increase of 10 degrees Celsius or more above the average body temperature. Fifty-two percent of the dentists in our survey group knew that using gutta-percha could be dangerous to patients' health. Poly methyl methacrylate, or PMMA for short, is a type of dental material commonly used to create prosthetics like dentures, crowns, and custom trays¹⁸. There's a chance it could cause skin irritation, inflammation, and allergic reactions like hives, blisters, and even necrosis^{2, 18}. About 90% of our study participants were sensitive to PMMA.

Mild to severe cytotoxic reactions can be triggered by Zn phosphate $Zn_3(PO_4)_2$ cement, however these reactions lessen with time as Zn ions leach out of the cement and the pH drops. In this method, the pulp is protected from damage. It is advised that a protective coating of dentine-bonding agent, ZOE, cavity varnish, or $Ca(OH)_2$ be placed on top of the $Zn_3(PO_4)_2$ cement when preparing deep cavities. In its place, you may try using cavity varnish^{4, 19}. In our study, eighty percent of the total participants were aware of the exact cause of why protective layer of any other cement is applied below zinc phosphate in deep cavities while 20% had no knowledge about it.

Zinc Oxide eugenol is a commonly used dental material and is utilized mostly in temporary fillings, cements, for secondary impressions and as perio dressings. It is also used to relief pain and have antibacterial properties²⁰. Literature reveals that eugenol is a known cytotoxic and allergic substance². Sixty-two percent of our study sample were aware of the adverse reactions associated with eugenol.

Titanium and its alloys are utilized for the fabrication of dental implants and its related components²⁴. While an essentially inert material, it is also associated with allergic reactions ranging from slight pain, skin rashes to implant failure^{21, 22}. Only five percent of our population had patients with titanium allergy while majority, ninety-five percent, had never encountered such a patient. A study done by Nur Liyana showed that only twenty-nine percent of dental students had encountered patients with titanium allergy²⁴. A similar survey done by Kadambari Sriram et al reported forty-eight percent dentists' interaction with patients of titanium allergy²³. Our numbers are probably a consequence of our dental students' limited exposure to implant placement.

Due to this limited exposure only seven percent of our study population had adequate knowledge about diagnostic tests for titanium allergy. The results from a previous study done by Nur liyana et al showed that majority of respondents, eighty-five percent were aware of methods and tests used to diagnose titanium allergy²⁴. Again, we believe that this discrepancy of results is because of limited exposure of our sample to titanium implants.

In our study thirty-nine percent dentists chose rashes as most common symptom associated with titanium allergy, twenty-six percent chose redness, sixteen percent selected others while fifteen percent responded with itching and four percent opted for muscle pain. A study done by Nur Liyana and Kiruba showed that thirty-nine percent dental students chose itching as the most common symptom of titanium allergy and followed by rashes²⁴. When it came to symptoms, we found that some of our sample had adequate knowledge about the symptoms associated with titanium allergy.

The most popular bleaching agent employed by dental practitioners is hydrogen peroxide⁴. Concerns about cytotoxicity of using 30% hydrogen peroxide was reported²⁰. Awareness about cytotoxicity of 30% hydrogen peroxide from our study was reported by only sixty-seven percent of our sample.

Only sixty-nine percent of practitioners prescribed medication to patients who underwent allergic reactions to variable dental materials. Also, ninety percent of our participants were aware of alternative materials to allergy causing materials. Our results were much better than those from those from kadambarisiran's study that showed that only thirty-six percent knew what materials to use when patient's allergy to dental materials becomes evident²³.

It is however, important to consider some limitations of our study. One of them is that the data was collected from a single educational institute. This may have resulted in positive results. We believe that there will be variations in results if the data is collected from a range of different hospitals and private dental practices. It is also important to note that our data was collected from an educational institute, since the knowledge in educational institutes is continuously reinforced, there is a high likelihood for positive results. So, we believe that additional investigations are required with appropriate sample size and diversity of sample population for definitive assessment.

CONCLUSION

In conclusion, our participants have sufficient knowledge about the adverse effects of dental materials. Their basic knowledge on biocompatibility related issues seems sufficient but they don't have enough knowledge about titanium allergies. The reason for their insufficient knowledge can be the fact that titanium is mostly used in implant dentistry which is done by a specialist in maxillofacial surgery or prosthodontics, whereas majority of our study population comprised of fresh house officers and trainees who are unfortunately not exposed to implant patients much.

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