

Awareness of Allergic reactions to Dental drugs and materials among Patients, Dentists and Dental personnel - A Cross sectional Study

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Abstract:

Objective: This study aims at examining the effects of the drugs and dental materials used in dental practices on patients and the dental personnel and the allergies manifested by them which may in some cases be adverse.

Materials And Methods: A self-administered questionnaire was distributed among 100 participants of whom 50 were dental patients and 50 were dentists and dental personnel for data acquisition. The chi-square test was applied for the statistical analysis.

Results: Awareness of allergic reactions due to dental products was low among the patients with only 28% of study population reporting awareness. The chi-square test for patients represented revealed significant association for variables such as observation of other people experiencing reaction ($p=0.013$) and patients association of adverse reactions with dental materials ($p=0.009$) to awareness of allergies due to dental drugs. 72% of the dentists and dental staff were shown to be aware of allergic reactions due to dental products but were found to have low awareness of the management of these reactions.

Conclusion: Majority of the patients have either not experienced or observed these reactions or have not associated these reactions with dental products leading to under-reporting of cases. A majority of the Dentists and dental personnel are shown to be aware of adverse reactions due to dental products but are not fully aware of the various methods of management of these adverse reactions. It is essential for Dental practitioners to be aware of these allergic reactions in order to improve quality of service in dental practice.

Keywords: Allergy, Awareness, Dental Practice, Dental materials, Drugs

INTRODUCTION:

The oral cavity is always prone to exposure to a variety of potentially sensitizing substances or irritants. There is a high chance for different substances like topical medications, synthetic resins, disinfecting agents, metals, etc. to come into contact with the oral mucosa during routine dental treatment [1]. Adverse reactions to medications which are prescribed to patients or administered during treatment in dental practice is a source of worry.

An allergic response or adverse reaction can be defined as a detrimental immune mediated hypersensitivity response to certain substances [2]. Adverse drug reactions are classified into type A or type B conventionally. Type A reactions are common and caused by the pharmacological effects of drugs resulting in nausea, tachycardia, etc. Type B reactions seldom occur and are considered unpredictable. They may also occur due to pseudo-allergies [3]. Adverse events occurring in patients undergoing dental treatment seem to be infrequent or rarely reported despite the exposure to dental drugs and materials.

Adverse reactions occur due to either contact allergies and a very small percentage of the cases show reactions after administration of Local anesthesia, yet other types of allergies like, immediate type allergy to these agents is quite uncommon⁴.

Patients with symptoms or signs of stomatitis, oral lichenoid lesions, lip and facial swelling may relate their problems to dental procedures or to the use of dental products [4].

Titanium is mostly a non-allergenic material, however several studies have reported cases in which metal allergies have been caused by titanium containing materials [5].

Symptoms of the allergic hypersensitivity appear not only in the oral cavity but also on hands, feet or the entire body. Previous Research conducted from July 2000 to June 2005 funded by Torii Pharmaceutical Corporation found that common metallic allergens were Nickel (25%), Palladium (24.4%) and Chromium (16.7%) which indicated that dentists and dental researchers should be concerned about the allergenic potential of dental metal materials [6].

Due to constant contact with Dental materials, occupationally related problems are common in dental personnel. The most common allergic reactions being immediate type allergy to latex, acrylates and formaldehyde [4]. Risk analyses are considered indispensable in the evaluation of drug therapy but are not so considered for the evaluation of the biological effects of dental treatment because the side-effects occur infrequently and if not severe, are categorized as discomforts [7].

This cross sectional questionnaire based study aims to study the awareness amongst the dental personnel,

practitioners and patients to allergies and adverse reactions due to dental drugs and materials.

MATERIALS AND METHODS:-

The study was approved by Saveetha Dental College, Scientific Review Board, Chennai, India. A total of hundred participants were selected at random, fifty dental patients and fifty being dental practitioners and staff from clinics in Chennai.

Study population:

Fifty dental patients and fifty dental practitioners and dental personnel from clinics in Chennai were approached.

Methods:

The questionnaires were self-formulated and was delivered by hand and collected on completion. The medium of answering the questionnaires was English. All the responses of the questionnaires were kept anonymous. The questions were framed in order to assess the awareness of dental patients and dental staff of adverse reactions due to dental drugs and materials. The data collected is entered and analyzed using SPSS software, IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. The results are tabulated and described in tables, bar graphs and pie charts

Questionnaire design:

The questionnaires were self-formulated and were designed to study the awareness of dental patients and dental staff and practitioners of adverse reactions due to dental drugs and materials. The questions were chosen with relevance to clinical conditions and practice. Some of the questions required the respondents to choose all the options which applied to their condition. There were a few questions requiring a 'Yes-or-No' answer. The questionnaires differed in a few questions as one was modified to assess the awareness in patients while the other assessed the awareness of the dentists and dental personnel.

The questionnaires are reproduced below:

A. Questionnaire given to the patients:

1. Name : _____
2. Age : _____
3. Sex:
 - Male
 - Female
4. Address : _____
5. Telephone No. : _____
6. Occupation : _____
7. Do you suffer from any allergic reactions?
8. What symptoms do you experience?(tick all that apply)
 - sneezing
 - blocked or running nose
 - Itchiness in the eyes
 - Asthma
 - lip and facial swelling
 - Rashes
 - Vomiting
 - Skin problems
 - Others
 - No allergy
9. Do you have a family history of allergic reactions?
 - Yes
 - No
10. Past medical history (tick all that apply)
 - Diabetes
 - Cancer
 - Anemia
 - Kidney diseases
 - Liver diseases
 - Heart diseases
 - Surgeries
 - Dental procedures
 - Other
 - No past medical history
11. Do certain foods cause you to suffer some reactions?
 - Yes
 - No
12. Are you aware of allergies due to dental drugs and materials?
 - Yes
 - No
13. Do you suffer from any reactions during or after dental procedures?
 - Yes
 - No
14. Do any of these symptoms occur?
 - stomatitis
 - burning
 - cheilitis
 - oral lichenoid lesions
 - lip and facial swelling
 - hand or facial dermatitis
 - respiratory distress
15. What do you think triggers these reactions?
 - Local anesthetics
 - Non-steroidal anti-inflammatory drugs
 - Opioids
 - Antibiotics
 - Latex
 - Cements
 - Metal alloys
 - Acrylates
 - Composites and resins
 - Others
 - No reactions
16. Is there anything that improves your problem?
 - Antihistamines
 - Decongestants
 - Nasal steroids
 - Inhaled steroids
 - Nasal decongestants
 - Oral steroids
 - Antibiotics
 - Albuterol
17. Have you observed other people experiencing reactions to any of the above?
 - Yes
 - No
18. Do you feel any discomfort due To?
 - Certain post- operative medications
 - Inhalation of certain drugs
 - Contact with any dental materials
 - Others
 - No discomfort
19. Does administration of local anesthesia make you nauseous?
 - Yes
 - No

20. Are the adverse reactions recurring?
- Yes
 - No
 - No adverse reactions
21. How would you rate the intensity of the reactions if they occur?
- Mild
 - Moderate
 - Severe
 - Very severe
 - No reactions
22. If you suffer a reaction or adverse symptom will you associate it with dental materials?
- Yes
 - No
- B. Questionnaire given to the dentists and dental personnel:**
1. Name _____
2. Age _____
3. Sex
- Male
 - Female
4. Address _____
5. Telephone no. _____
6. Occupation _____
7. Do you suffer from any allergic reactions?
- Yes
 - No
8. What symptoms do you experience? (Tick all that apply)
- sneezing
 - blocked or running nose
 - Itchiness in the eyes
 - Asthma
 - lip and facial swelling
 - Rashes
 - Vomiting
 - Skin problems
 - Others
 - No allergy
9. Do you have a family history of allergic reactions?
- Yes
 - No
10. Past medical history(tick all that apply)
- Diabetes
 - Cancer
 - Anaemia
 - Kidney diseases
 - Liver diseases
 - Heart diseases
 - Surgeries
 - Dental procedures
 - If other, specify
 - No past medical history
11. Do certain foods cause you to suffer some reactions?
- Yes
 - No
12. Are you aware of allergies due to dental drugs and materials?
- Yes
 - No
13. Do you suffer from any reactions during or after dental procedures?
- Yes
 - No
14. Do any of these symptoms occur during dental procedures?
- stomatitis
 - burning
 - cheilitis
 - oral lichenoid lesions
 - lip and facial swelling
 - hand or facial dermatitis
 - respiratory difficulties
15. What do you think triggers these reactions?
- Local anaesthetics
 - Non- steroidal anti -inflammatory drugs
 - Opioids
 - Antibiotics
 - Latex
 - Cements
 - Metal alloys
 - Acrylates
 - Composites and resins
 - Others
 - No reactions are triggered
16. Is there anything that improves your problem?
- Antihistamines
 - Decongestants
 - Nasal steroids
 - Inhaled steroids
 - Nasal decongestants
 - Oral steroids
 - Antibiotics
 - Albuterol
17. Have you observed patients suffering from any adverse reactions?
- Yes
 - No
18. Does administration of certain post -operative drugs make them nauseous?
- Yes
 - No
19. Do you suffer from nausea or any reactions while administering treatment to the patients?
- Yes
 - No
20. Are the adverse reactions encountered due to the dental drugs or materials recurring?
- Yes
 - No
 - No adverse reactions
21. How would you rate the intensity of the reactions if they occur?
- Mild
 - Moderate
 - Severe
 - Very severe
 - No reactions

22. If patients suffer from adverse reactions do you prescribe any medication?
 - Yes
 - No
23. Are there any possible alternatives to the allergy causing materials which can be used in treatment?
 - Yes
 - No
24. Are there any ways to minimise the occurrence of reactions on exposure? If yes name them.
 - Yes
 - No

RESULTS:

ANALYSIS AND INTERPRETATION- AWARENESS AMONG DENTAL PATIENTS

The study participants are patients visiting dental clinics in Chennai. A total of 50 patients were selected for assessing the awareness among patient for dental allergies due to dental drugs and materials. The socio-economic, demographic status of the patients is based on age and gender and oral health.

TABLE 1. Frequency distribution of demographic variables of the respondents (N=50).

CHARACTERISTICS		DISTRIBUTION OF RESPONDENTS (N=50)	
		N	Percentage
AGE	<20	11	22%
	21-30	10	20%
	31-40	7	14%
	41-50	7	14%
	51-60	3	6%
	61-70	6	12%
GENDER	Male	20	40%
	Female	30	60%

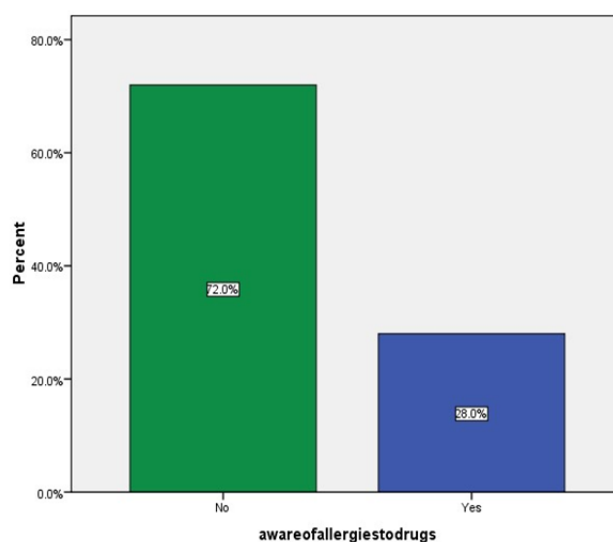
According to *TABLE 1*, the study population consists of 20 (40%) male and 30 (60%) female patients and the majority 22% (n=11) patients were less than 20 age group were as 20% (n=10) patients were 21-30 age group.

TABLE 2. The descriptions of the aware of allergic to drug versus feature of the individual factors are listed below.

VARIABLES		Aware of allergy to drugs	
		NO	YES
Do you suffer from any allergic reaction	No	20	10
	Yes	16	4
Do you have family history of allergic reaction	No	26	10
	Yes	10	4
Do you suffer from any reaction during or after dental procedure	No	33	12
	Yes	3	3
Are the adverse reactions recurring	No	16	9
	Yes	20	5

TABLE 2. The above table represents the allergic reaction of the patients with respect to aware of allergic reactions due to dental drugs. Considering the variables listed in *TABLE 2* only 4 patients are both aware of allergic reactions due to drugs as well as suffer from allergic reactions. 26 patients have neither a family history of allergic reactions nor do they suffer from allergic reactions while 4 patients have both a family history of allergic reactions and are aware of reactions due to dental drugs. A majority of 33 patients do not suffer from allergic reactions both during and after a dental procedure and also do not have any awareness of allergies due to dental drugs. Adverse reactions are reported to be recurring in 5 patients who are also aware of allergies due to dental drugs.

Figure 1. Awareness Of Allergies Due To Dental Drugs And Materials



The above diagram, *FIGURE 1*, represents the awareness of allergies due to dental drug or materials. Overall 72% of the patients are unaware of the allergies due to dental drugs and only 28% of the patients are aware about allergies.

Figure 2. Medications which improve the patient's condition

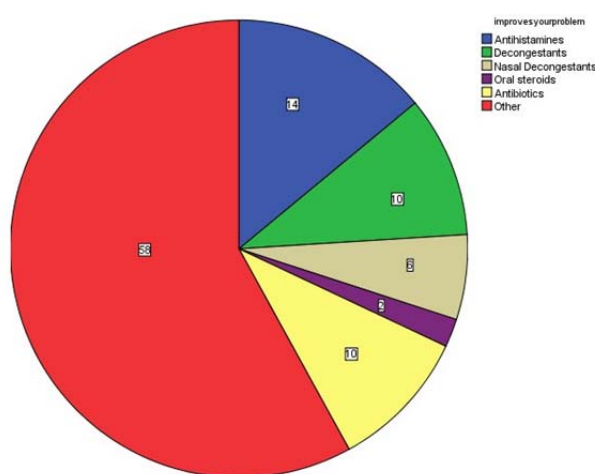


Figure 2, shows that overall 58% of the patients chose other medications, followed by antihistamines chosen by 14% of the patients, Decongestants chosen by 10%, Antibiotics chosen by 10%, Nasal Decongestants chosen by 6% and the least response is to oral steroids chosen by 2%.

CHI-SQUARE TEST FOR INDEPENDENCE OF ATTRIBUTES

Hypothesis:

H0: There is no significant association between Aware of allergies due to dental drugs and Variables (Gender, Food allergies, Observation of other people experiencing reaction, nausea due to Local anesthesia and patients association of adverse reactions with dental materials).

H1: There is significant association between Aware of allergies due to dental drugs and Variables (Gender, Food allergies, Observation of other people experiencing reaction, nausea due to Local anesthesia and patients association of adverse reactions with dental materials).

TABLE 3: Chi-Square Test for Comparing the Variables

VARIABLES		Aware of allergies due to dental drugs		Chi-Square	P-value
		No	Yes		
Gender	Male	17	3	2.794	0.087
	Female	19	11		
Food allergies	No	29	12	0.182	0.510
	Yes	7	2		
Observation of other people experiencing reaction	No	22	3	6.349	0.013
	Yes	14	11		
Nausea due to Local anesthesia	No	34	12	1.044	0.310
	Yes	2	2		
Patients association of adverse reactions with dental materials	No	33	8	8.140	0.009
	Yes	3	6		

The chi-square test represented in TABLE 3, revealed the significant association for variables such as observation of other people experiencing reaction ($p=0.013$) and patients association of adverse reactions with dental materials ($p=0.009$) which are closely associated to awareness of allergies due to dental drugs. But significant association with food allergies, nausea due to local anesthesia are proven to be untrue.

ANALYSIS AND INTERPRETATION- AWARENESS AMONG DENTISTS AND DENTAL PERSONNEL

The study participants include the dentists and dental personnel who assist patients in dental clinics in Chennai. A total of 50 respondents were selected to assess awareness among the participant of dental allergies due to dental drugs and materials. The socio-economic, demographic status of the participants is based on age and gender and oral health.

TABLE 4. Frequency distribution of demographic variables of the respondents (N=50)

CHARACTERISTICS	DISTRIBUTION OF RESPONDENTS (N=50)		
	N	Percentage	
AGE	21-30	16	32%
	31-40	16	32%
	41-50	9	18%
	51-60	9	18%
GENDER	Male	13	26%
	Female	37	74%

The study population consists of 13 (26%) male and 37 (74%) female participants and the majority of age group of participants are from 21-30 and 31-40 both are 32% and whereas rest of them from 41-50 and 51-60 both are 18%.

TABLE 5. The descriptions of the aware of allergic to drug versus feature of the individual factors are listed below.

VARIABLES	Aware of allergic to drug		
	NO	YES	
Do you suffer from any reactions during or after dental procedure	No	17	31
	Yes	0	2
Have you observed patients suffering from any adverse reactions	No	8	9
	Yes	9	24
Certain post-operative drugs make them nauseous	No	15	23
	Yes	2	10
Do you suffer from nausea or any reactions while administering treatment to the patients	No	17	32
	Yes	0	1
Adverse reactions encountered due to the dental drugs or materials recurring	Yes	1	8
	No	5	3
	No adverse reactions	11	22

TABLE 5. The above table represents the allergic reactions of the respondents with respect to awareness of allergic reactions due to dental drugs and materials. According to TABLE 5, considering the variables only 2 respondents are shown to have suffered from allergic reactions as well as being aware of allergies due to dental drugs and materials. 31 respondents are found to be aware of allergies due to dental drugs and materials but do not suffer from any adverse reactions. 24 respondents have reported observation of patients suffering from allergic reactions due to dental drugs and are also aware of the same. Nausea is not suffered by a majority of 32 respondents while administering treatment to patients who are also aware of allergies due to dental drugs. The adverse reactions are found to be recurring by 22 respondents who are also aware of allergic reactions due to dental drugs and materials.

Figure 3. Awareness of Allergies Due To Dental Drugs and Materials

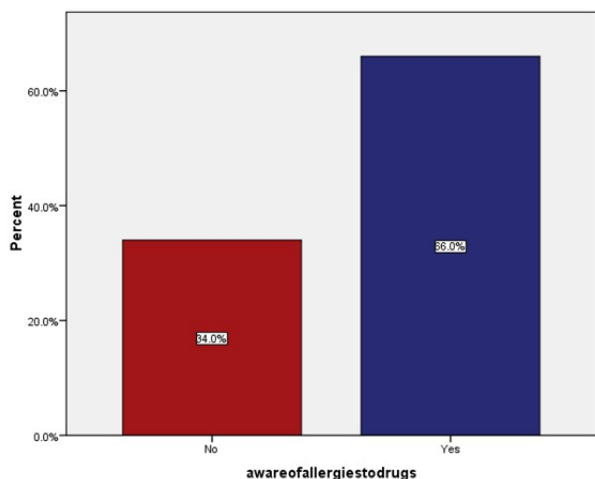
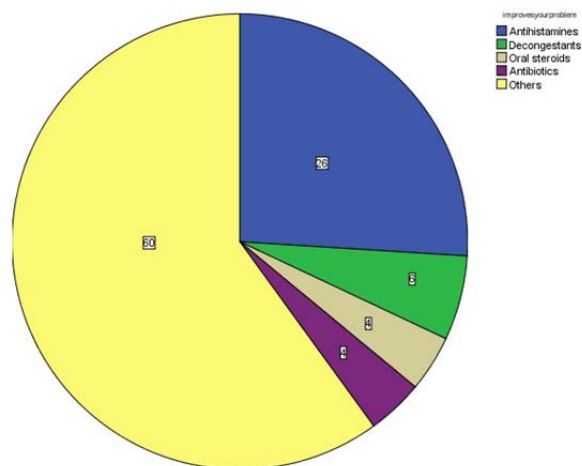


Figure 3, represents the awareness of allergies due to dental drug or materials. Overall 66% of the respondents are aware of the allergies due to dental drugs and only 34% of the respondents are aware about allergies.

Figure 4. Medications which improve the participant's condition



The medications most routinely used by the participants to improve their condition is represented in Figure 4, where it can be seen that a majority of 60% of the participants choose other means of improving their condition (means other than those listed in the questionnaire). Antihistamines are chosen by 26% of the respondents followed by decongestants chosen by 6%, antibiotics chosen by 4% and oral steroids were also chosen by 4% of the respondents.

CHI-SQUARE TEST FOR INDEPENDENCE OF ATTRIBUTES

Hypothesis:

H0: There is no significant association between Aware of allergies due to dental drugs and Variables (Participants suffering from any allergic reaction, Food allergies , Prescription of medication for patients suffering reactions, Alternatives to the allergy causing materials and minimizing the occurrence of reactions).

H1: There is significant association between Aware of allergies due to dental drugs and Variables (Participants suffering from any allergic reaction, Food allergies , Prescription of medication for patients suffering reactions, Alternatives to the allergy causing materials and minimizing the occurrence of reactions).

TABLE 6: Chi-Square Test for Comparing the Variables

VARIABLES	Aware of allergies due to dental drugs		Chi-Square	P-value
	No	Yes		
Participants suffering from any allergic reactions	No	14	3.766	0.049
	Yes	3		
Food allergies	No	17	5.654	0.017
	Yes	0		
Prescription of medication for patients suffering adverse reactions	No	15	4.079	0.041
	Yes	2		
Possible alternatives to the allergy causing materials which can be used in treatment	No	15	6.566	0.010
	Yes	2		
Ways to minimize the occurrence of reactions on exposure	No	15	3.368	0.063
	Yes	2		

The chi-square test with reference to TABLE 6, revealed the significant association for the variable such as participants suffering from any allergic reactions (p=0.049), food allergies (p=0.017), prescription of medication for patients (p=0.041), possible alternatives to the allergy causing materials which can be used in treatment (p=0.010) which are closely associated to awareness of allergies due to dental drugs and materials. But the association between ways to minimize the occurrence of reactions on exposure and awareness is proved to be untrue.

DISCUSSION:

This was a cross-sectional questionnaire based study which was distributed among 100 respondents in Chennai. 50 of them were dental patients and the other 50 comprised of dentists and dental personnel. Patients undergoing dental treatment can be exposed to a wide range of potential allergens, but adverse reactions are found to be quite infrequent. This study was conducted therefore to assess the awareness amongst the dental patients, dentists and dental personnel.

The main allergic reactions found in patients and dental personnel include contact allergy to metals, flavors, acrylates and immediate type allergy to latex. Adverse

reactions following the administration of local anesthetics are seen in about 0.5% of cases, but immediate type allergy to these agents is seldom observed [3]. In dental personnel, occurrence of adverse reactions are occupationally related and are more common. They usually manifest as dermatitis, respiratory disease, etc. Occupational irritant reactions causing hand dermatitis are probably more common in dental personnel than is dermatitis caused by contact allergy. The most common allergic reactions in dental personnel and dentists are immediate type allergy to latex, contact allergy to rubber additives, acrylates and local anesthesia [8-10]. Dentists and their staff use many potential allergens and irritants in their profession. Many of these materials can be allergens, irritants or sometimes both [3].

The incidence of adverse reactions to dental treatment and dental drugs has been found to be difficult to estimate and also seems to be low considering the number of dental treatments undertaken [8,9,10].

There is therefore a need to continue to raise the awareness among dental professionals of the existence of the Adverse Reactions Reporting Project so as to overcome problems of under-reporting [11].

On comparing the occurrence of allergic reactions in the patients and their awareness of allergic reactions due to dental products, it was found that only 4 patients suffering from adverse reactions during dental procedures are also aware of allergic reactions due to dental drugs and materials. 32% of the respondents have a family history of allergic reactions but are also unaware of allergic reactions due to dental products. A majority of 33 respondents do not suffer from any reactions during or after dental procedures while 5 respondents have reported adverse reactions during dental procedures and are also aware of the same.

Out of the 50 patients chosen for the study a majority (72%) have been found to be unaware of allergic reactions due to dental drugs and materials. Drug allergy are one of the types of unpredictable adverse drug reaction that encompass a spectrum of immunologically-mediated hypersensitivity reactions with varying mechanisms and clinical manifestations. This is a possible explanation for the lack of awareness amongst patients and a reason for under-reporting [12].

Considering the study population consisting of dentists and dental personnel, the variables associated with the allergic reactions of the participants were compared to awareness of allergic reactions due to dental drugs and materials. Considering the variables only 2 of the participants have reported to be both aware of reactions due to dental products as well as suffer from adverse reactions due to them. Awareness was reported by 48% of the respondents who have also observed patients suffering from adverse reactions in their practice. 64% of the respondents (32) who are aware of these allergic reactions have not suffered from nausea while administering treatment to patients. The analysis has shown 66% of the respondents to be aware of dental allergies.

The medications used for management of adverse reactions were recorded. 58% of the patient population chose medications other than those listed in the questionnaire,

while 60% of the dentists and dental personnel chose the above. Antihistamines were chosen by 14% of the patient population, whereas it was chosen by 26% of the dental personnel.

The adverse reactions manifesting in the skin are known to be mediated by histamine and can be managed using an antihistamine such as diphenhydramine [13, 14]. Major reactions involving the respiratory tract and in severe cases the cardiovascular system are mediated physiologically by effects provided by epinephrine [15,16]. Additional agents mentioned frequently in dental literature for managing asthma, allergic, or anaphylactic reactions include aminophylline and corticosteroids [2]. It is important to note that only 4% of the dentists and dental staff chose oral steroids as medication for adverse anaphylactic reactions which indicates that 94% are possibly unaware of its use after the use of epinephrine. According to Eskandari et al (2014) most dentists who encounter patients with anaphylaxis in their clinics do not seem to be aware of the urgency of this condition, this increased in this field in the last few years.

Analysis using the chi-square test was performed for both the patient population and the dental personnel. Considering the patients, the chi-square test revealed the significant association for variables such as observation of other people experiencing reaction ($p=0.013$) and patients association of adverse reactions with dental materials ($p=0.009$) which are closely associated to awareness of allergies due to dental drugs. But significant association with food allergies, nausea due to local anesthesia was shown to be untrue. Patient awareness is seen to be closely associated with either experience of adverse reactions or observing the occurrence of these adverse reactions in fellow patients.

On analyzing the dental staff and dentists, the chi-square test revealed the significant association for the variable such as participants suffering from any allergic reactions ($p=0.049$), food allergies ($p=0.017$), prescription of medication for patients ($p=0.041$), possible alternatives to the allergy causing materials which can be used in treatment ($p=0.010$) which are closely associated to awareness of allergies due to dental drugs and materials. But the association between ways to minimize the occurrence of reactions on exposure and awareness was shown to be insignificant.

It is important to consider the limitations of the present study. This is a cross-sectional study and it is important to note that there is prevalence of under reporting of adverse reactions amongst patients due to lack of awareness. Cross-sectional studies are carried out at a single point in time there may be variations in the results if a larger study population is chosen.

CONCLUSION:

Research shows that the awareness of allergic reactions due to dental drugs and materials is low amongst patients due to the varied mechanisms and clinical manifestations of these reactions, infrequent appearance and low severity of these reactions. The study has shown that majority of the patients have either not experienced or observed these reactions or

have not associated these reactions with dental products leading to under-reporting of cases. A majority of the Dentists and dental personnel are shown to be aware of adverse reactions due to dental products. Yet they are not fully aware of the various methods of management of these adverse reactions. It is thus important for Dental practitioners to be aware of allergic reactions due to dental drugs and materials in order to reduce the severity of the occurring reactions as well as promote the use of alternatives.

REFERENCES:

1. Hauman CH, Love RM. Biocompatibility of dental materials used in contemporary endodontic therapy: a review. Part 1. Intracanal drugs and substances. *International endodontic journal*. 2003 Feb 1;36(2):75-85.
2. Becker DE. Drug allergies and implications for dental practice. *Anesthesia progress*. 2013 Dec;60(4):188-97.
3. Gawkrödger DJ. Investigation of reactions to dental materials. *British Journal of Dermatology*. 2005 Sep 1;153(3):479-85.
4. Ditrichova D, Kapralova S, Tichy M, Ticha V, Dobesova J, Justova E, Eber M, Pirek P. Oral lichenoid lesions and allergy to dental materials. *Biomedical Papers*. 2007 Dec 1;151(2):333-9.
5. John KR. Biocompatibility of dental materials. *Dental Clinics of North America*. 2007 Jul 31;51(3):747-60.
6. Hosoki M, Bando E, Asaoka K, Takeuchi H, Nishigawa K. Assessment of allergic hypersensitivity to dental materials. *Biomedical materials and engineering*. 2009 Jan 1;19(1):53-61.
7. Mjör IA. Problems and benefits associated with restorative materials: side-effects and long-term cost. *Advances in dental research*. 1992 Sep 1;6(1):7-16.
8. KALLUS T, MJÖR IA. Incidence of adverse effects of dental materials. *European Journal of Oral Sciences*. 1991 Jun 1;99(3):236-40.
9. Jacobsen N, Aasenden R, Hensten-Pettersen A. Occupational health complaints and adverse patient reactions as perceived by personnel in public dentistry. *Community dentistry and oral epidemiology*. 1991 Jun 1;19(3):155-9.
10. Jacobsen N, Hensten-Pettersen A. Occupational health problems and adverse patient reactions in orthodontics. *The European Journal of Orthodontics*. 1989 Aug 1;11(3):254-64.
11. Scott A, Egner W, Gawkrödger DJ, Hatton PV, Sherriff M, Van Noort R, Yeoman C, Grummitt J. The national survey of adverse reactions to dental materials in the UK: a preliminary study by the UK Adverse Reactions Reporting Project. *British dental journal*. 2004 Apr 24;196(8):471-7.
12. Eskandari N, Nekourad M, Bastan R. The awareness of anaphylaxis reaction to local anesthesia in Dentistry. *Journal of Allergy and Asthma*. 2014 Jan 28;1(1):1.
13. Beyea SC, Nicoll LH. Administration of medications via the intramuscular route: an integrative review of the literature and research-based protocol for the procedure. *Applied nursing research*. 1995 Feb 28;8(1):23-33.
14. Audrey B. Kozier and Erb's Fundamentals of Nursing: Concepts, Process, and Practice, 8/e (With DVD). Pearson Education India; 2014.
15. Sampson HA, Muñoz-Furlong A, Campbell RL, Adkinson NF, Bock SA, Branum A, Brown SG, Camargo CA, Cydulka R, Galli SJ, Gidudu J. Second symposium on the definition and management of anaphylaxis: summary report—Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network symposium. *Annals of emergency medicine*. 2006 Apr 30;47(4):373-80.
16. Hoek TL, Morrison LJ, Shuster M, Donnino M, Sinz E, Lavonas EJ, Jeejeebhoy FM, Gabrielli A. Part 12: cardiac arrest in special situations 2010 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010 Nov 2;122(18 suppl 3):S829-61.