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Knowledge, Attitude And Practice Regarding Nickel Hypersensitivity In Patients Undergoing Orthodontic Therapy Among Interns. - A Questionnaire Survey.

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Abstract: Nickel is one of the most common causes of allergic contact dermatitis and produces more allergic reactions than all other metals combined. Currently, several brands of orthodontic wires are made of nickel titanium alloy and potentially have a high enough nickel content to provoke manifestations of allergic reactions in the oral cavity. The main objective of this study is to evaluate the knowledge and awareness on nickel hypersensitivity in patients among interns in a private dental college. The study was conducted in a private dental college, Chennai. The study group consisted of the interns and postgraduate students. Total number of studies included in the study was 200.The statistical analysis was done using SPSS software (SPSS version 21.0, SPSS, Chicago II, USA). The data was analysed using a chi- square test. The p value of less than 0.05 was considered to be statistically significant.About 73% of them are aware about Nickel Hypersensitivity and 74.5% are aware that Nickel hypersensitivity is one of the most common causes for allergic contact dermatitis. Higher number of females reported to know about Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about Nickel Hypersensitivity.Chi- square value: 0.059, p value: 0.807. Dental students in this study have a good level of knowledge and positive attitude towards nickel hypersensitivity in patients. However, the knowledge acquired must be implemented in their daily practice and provide the better treatment required for the patients. A better knowledge of nickel hypersensitivity is essential for safe practice in dentistry. This will ensure the provision of better and safer dental health care services for the population.

Keywords: Interns; Nickel dermatitis; Nickel dermatitis; Orthodontic appliances;Skin lesion.

INTRODUCTION

An allergic response is one in which certain components of the immune system react excessively to a foreign substance. Two key allergic reactions have been described in the literature. Type I hypersensitivity reactions are an immediate antibody mediated allergic response, occurring within minutes or hours after direct skin or mucosal contact with the allergen.(Poley and Slater, 2000) Nickel alloys are widely used in the orthodontic in brackets, wires, bands and other orthodontic accessories. Nickel allergy occurs more frequently than allergy to all other metals combined.(Lowey, 1993) It is estimated that 11% of all women and 20% of women between the ages of 16 and 35 years have a sensitivity to nickel.6-8 Nickel-induced contact dermatitis is a Type IV delayed hypersensitivity immune response occurring at least 24 hours after exposure.(Al-Tawil, Marcusson and Moller, 1985)(Loon et al., 1988) It has been shown that the level of nickel in saliva and serum increases significantly after the insertion of fixed orthodontic appliances.(Souza, de Souza and de Menezes, 2008) Nickel leaching from orthodontic bands, brackets, stainless steel or Ni–Ti archwires has been shown in vitro to occur within the first week and then decline thereafter.(Barrett, Bishara and Quinn, 1993) It is suggested that a threshold concentration of approximately 30 ppm of nickel may be sufficient to elicit a cytotoxic response.(Bour et al., 1994) Scientific evidence suggests that orthodontic treatment is not associated with increase of Ni hypersensitivity, unless patients have a history of previous exposure to Ni. People with cutaneous piercing are considered a significant risk factor for Ni allergy.(Thyssen et al., 2007) however, oral exposure to nickel through dental braces prior to ear piercing reduces the risk of developing nickel allergy.(Mortz et al., 2002)(Hoogstraten et al., 2008)

Signs and symptoms of nickel allergy includes gingivitis, gingival hyperplasia, lip desquamation, burning sensation in the mouth, metallic taste, angular cheilitis, and periodontitis.(Staerkjaer and Menne, 1990)(Bishara, Barrett and Selim, 1993) In chronic cases, the affected mucosa is typically in contact with the causal agent and appears erythematous or hyperkeratotic to ulcerated.(Genelhu et al., 2005) Extraoral manifestations of nickel allergy may have an intra oral origin.(Schultz et al., 2004) If a nickel allergy is still in question, a diagnosis can be confirmed by a dermatologist by conducting a cutaneous sensitivity test called a patch test (Table 1) using 5% nickel sulphate in petroleum jelly.(Menné et al., 1987)

If intra - oral signs and symptoms are present and a diagnosis of nickel hypersensitivity is established, the fixed or removable prosthesis should be replaced with another nickel free alloy. The nickel titanium archwires should be removed and replaced with a stainless steel archwire which is low in nickel content or preferably a titanium molybdenum alloy (TMA) arch wire, known as "TMA", which does not contain nickel. Most patients who develop a reaction to Ni-Ti archwires subsequently tolerate stainless steel without a reaction.(Toms, 1988) Other options include fibre reinforced composite wires, Gold plated wires, Ion-implanted nickel-titanium arch wires or Plastic/Resin-coated nickel-titanium arch wires.(Kucukyildirim and Eker, 2012)

Stainless steel brackets are generally considered safe. However, nickel free alternative brackets to stainless steel include Ceramic brackets produced using polycrystalline alumina, single crystal sapphire, and zirconia, Polycarbonate brackets, Titanium brackets and Gold plated brackets and plastic brackets in selected cases Fixed appliances may be substituted with plastic aligners. Extra-oral metal components, including metal studs in headgear, are of greatest concern due to greater sensitivity of skin. Plastic coated headgear studs may be a better alternative for such patients. Previously our team has conducted numerous clinical trials, few review papers and surveys (Kumar et al., 2011; Felicita, Shanthasundari and Chandrasekar, 2012; Dinesh and Saravana Dinesh, 2013; Jain, 2014; Kamisetty, 2015; Krishnan, 2015; Rubika, Sumathi Felicita and Sivambiga, 2015; Viswanath et al., 2015; Sivamurthy and Sundari, 2016; Felicita and Sumathi Felicita, 2017a, 2017b, 2018; Samantha, 2017; Vikram and Raj Vikram, 2017; Krishnan, Pandian and Kumar, 2018). 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 present study aims to evaluate interns' awareness on nickel hypersensitivity in patients reporting to the clinic.

MATERIALS AND METHOD

Study design:

A cross sectional questionnaire based study was carried out among dental students of a Private Dental College in chennai who are practising in clinics.

Sample:

This study was conducted in an online setting. The sample comprised 200 participants. Simple random sampling methodology was employed.

Approval:

Informed consent and ethical approval was obtained from the Institutional Ethical Committee and Scientific Review Board of the University. (SDC/SIHEC/2020/DIASDATA/0619-0320).

Questionnaire:

The questionnaire was framed with the help of experts in the field. The questionnaire kept the study group in mind and questions were linked to curriculum content of nickel hypersensitivity. A self – administrated questionnaire consisting of 10 close ended questions. The dental students answered the questionnaire through an online setting survey planet. There were 10 questions to assess their knowledge, attitude and to judge their practices of the respondents on nickel hypersensitivity patients reporting to the clinic.

Statistical analysis:

The data from their response were entered in the excel sheets. The data was later exported to SPSS Software (SPSS version 21.0, SPSS, Chicago II, USA) for statistical analysis. The data was analysed using a chi-square test. The p value of less than 0.05 was considered to be statistically significant.

RESULTS AND DISCUSSION

Out of 200 participants, about 73% of them are aware about nickel hypersensitivity [GRAPH 1] and 74.5% are aware that nickel hypersensitivity is one of the most common causes for allergic contact dermatitis [GRAPH 2]. About 55% of the students gave positive responses about nickel being one of the components used in making

orthodontic wires [GRAPH 3]. From the chart it is observed that 38% of dental students have said that the daily dietary requirements for humans is 25 - 35 and 30 - 40. There was an equal distribution among these two [GRAPH 4]. Only about 12% were aware that 300 - 600 being the average diet supply of nickel to the human body per day[GRAPH 5]. About 94% of them were aware about the threshold concentration requirement of nickel to cause allergic reactions[GRAPH 6]. It is observed that 75.50% of them were aware about the intraoral signs and symptoms of nickel hypersensitivity[GRAPH 7]. Only about 19% were about the longevity of symptoms of nickel hypersensitivity[GRAPH 8]. About 48.5% of students were aware that patch test is the test used to diagnose nickel hypersensitivity in patients[GRAPH 9]. 70.5% of students are aware that both fibre reinforced composite wire and TMA are the alternative used in dentistry with various other alternatives[GRAPH 10]. Higher number of females reported to know about Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about Nickel Hypersensitivity.(p value: 0.807 (p>0.05 statistically non significant))[GRAPH 11] About 41.50% females reported to know about Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about Nickel Hypersensitivity being one of the common causes for allergic contact dermatitis.(p value: 0.886(p>0.05 statistically non significant))[GRAPH 12] About 29.50% of females reported to know about Nickel being one of the components used in making orthodontic appliances when compared to males. There was no significant difference between the gender and awareness about Nickel being one of the components used in making orthodontic appliances. (p value: 0.595(p>0.05 statistically non significant))[GRAPH 13] About 22.50% females reported to know about the daily dietary requirement of Nickel for humans when compared to males. There was no significant difference between the gender and awareness about the daily dietary requirement of Nickel for humans. (p value: 0.729(p>0.05 statistically non significant))[GRAPH 14] About 20% females reported to know about the average diet supply of Nickel for humans per day when compared to males. There was no significant difference between the gender and awareness about the average diet supply of Nickel for humans per day. (p value: 0.882(p>0.05 statistically non significant))[GRAPH 15] About 26% females know about the threshold concentration requirement of Nickel when compared to males. There was no significant difference between the gender and awareness about the threshold concentration requirement of Nickel. (p value: 0.811(p>0.05 statistically non significant))[GRAPH 16] About 42% females know about the intraoral signs and symptoms of Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about the intraoral signs and symptoms of Nickel Hypersensitivity. (p value: 0.859(p>0.05 statistically non significant))[GRAPH 17] About 22% females know about the longevity of the symptoms of Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about the longevity of the symptoms of Nickel Hypersensitivity.(p value: 0.902 (p>0.05 statistically non significant))[GRAPH 18] About 24.50% females know about the test used to diagnose Nickel Hypersensitivity when compared to males. There was significant difference between the gender and awareness about the test used to diagnose Nickel Hypersensitivity. (p value: 0.034 (p<0.05 statistically significant))[GRAPH 19] About 41% females know about the alternative used for Nickel containing stainless steel wire when compared to males. There was no significant difference between the gender and about the alternative used for Nickel containing stainless steel wire (p value: 0.607(p>0.05 statistically non significant))[GRAPH 20]

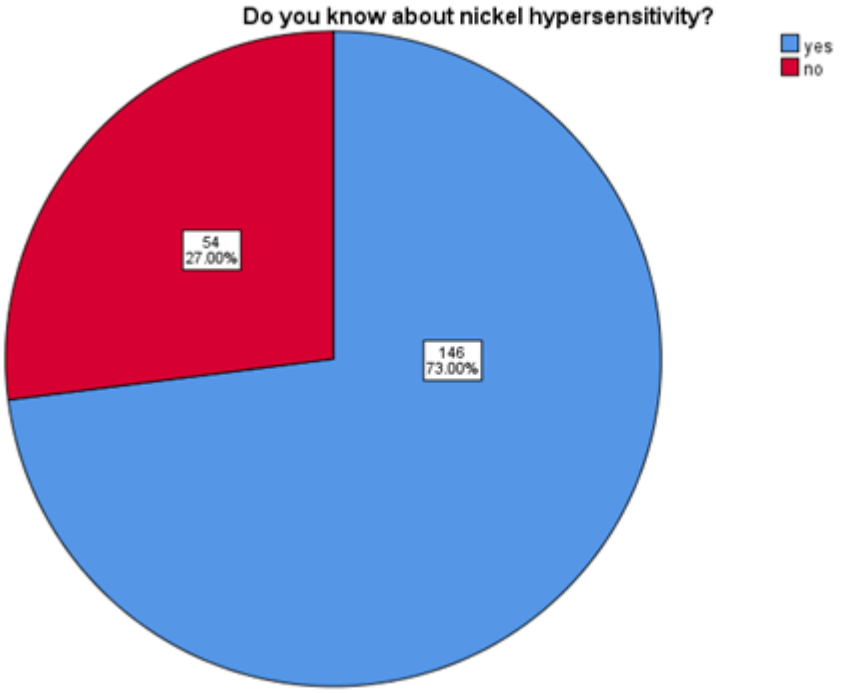
From this study, 73% of them are aware about nickel hypersensitivity and it is one of the most common causes for allergic contact dermatitis. However, a Scandinavian authors noted that a considerable number of nickel-sensitive patients developed dermatitis flare-up at sites different from those that have been in direct contact with nickel-plated items, so they speculated an endogenous exposure to Ni in patients with hip prosthesis or dental alloys.(Christensen and Möoller, 1975; Frigerio et al., 2011; Yilmaz, Ozdemir and Yilmaz, 2012)

From this study, 55% of the students gave positive responses about nickel being one of the components used in making orthodontic wires. Orthodontic arch wires that contained up to 54% nickel caused no cytotoxic effect. Similarly, it has been determined that the maximum amount of nickel released from orthodontic arch wires was 700 times lower than the amount necessary to elicit cytotoxic reaction in a human peripheral blood mononuclear cell culture. These findings are important as the use of high level nickel containing 'shape-memory' wires is increasing in Orthodontics.(Grimsdottir, Hensten-Pettersen and Kullmann, 1992; Jia et al., 1999)

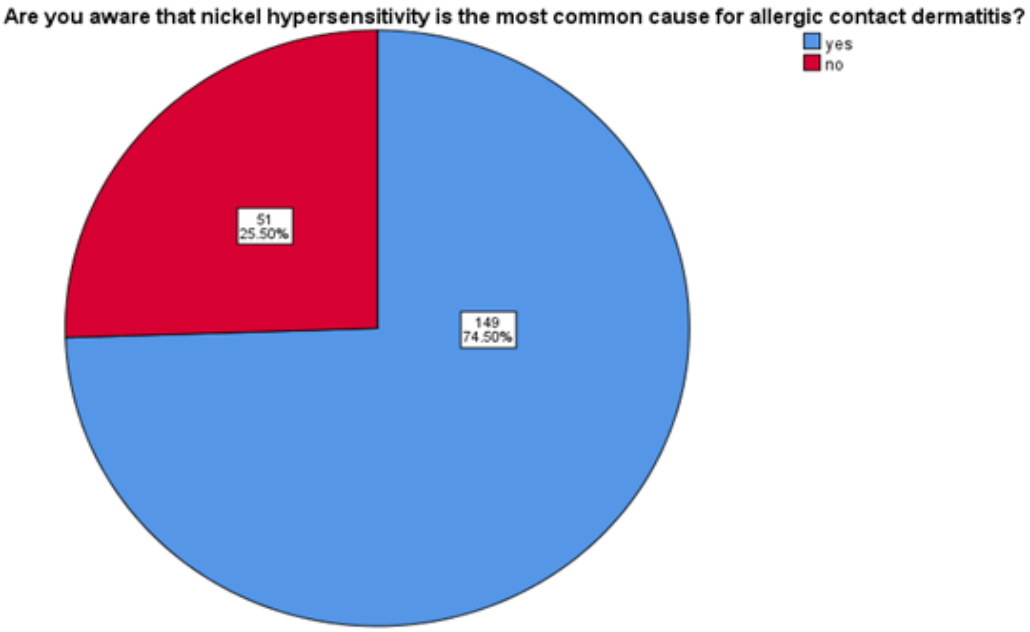
There is rising concern about the biocompatibility of dental materials; this might be due to a real increase in the occurrence of allergic reactions to the materials or to an increase in awareness of adverse effects from these materials.3 Allergy in patients undergoing orthodontic treatment can be seen due to several reasons and these include nickel allergy, allergy to the acrylic resins that are used during treatment. (Kucukyildirim and Eker, 2012)

Safe and effective practice depends on identifying patients with allergy along with knowledge of materials that can potentially cause them. Orthodontists should have basic understanding of allergic reactions and should be efficient enough to manage them.

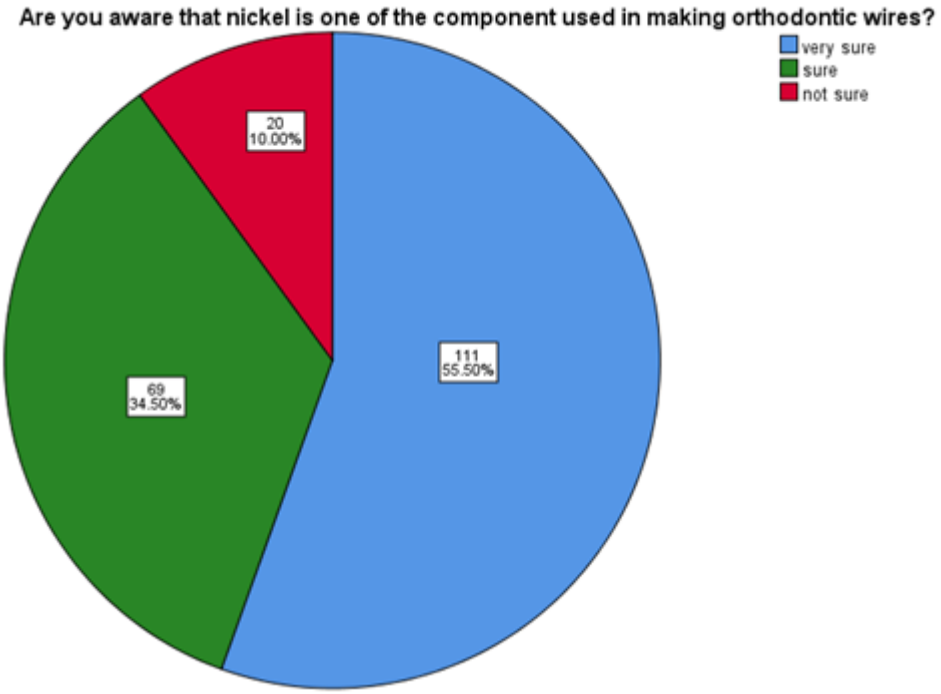
It is important for a clinician to not only know the physical and mechanical properties of the materials being used, but also of the biologic compatibility of the material. Knowledge of alternatives to allergy causing materials is also of prime importance in efficient management of patients in routine clinical practice.
A detailed history, with special attention to previous allergic reactions, is the main prognostic factor to avoid allergic reactions during orthodontic therapy. The clinician should be mindful of these reactions during the course of orthodontic treatment, and should know to diagnose and subsequent action to be taken in the treatment plan.



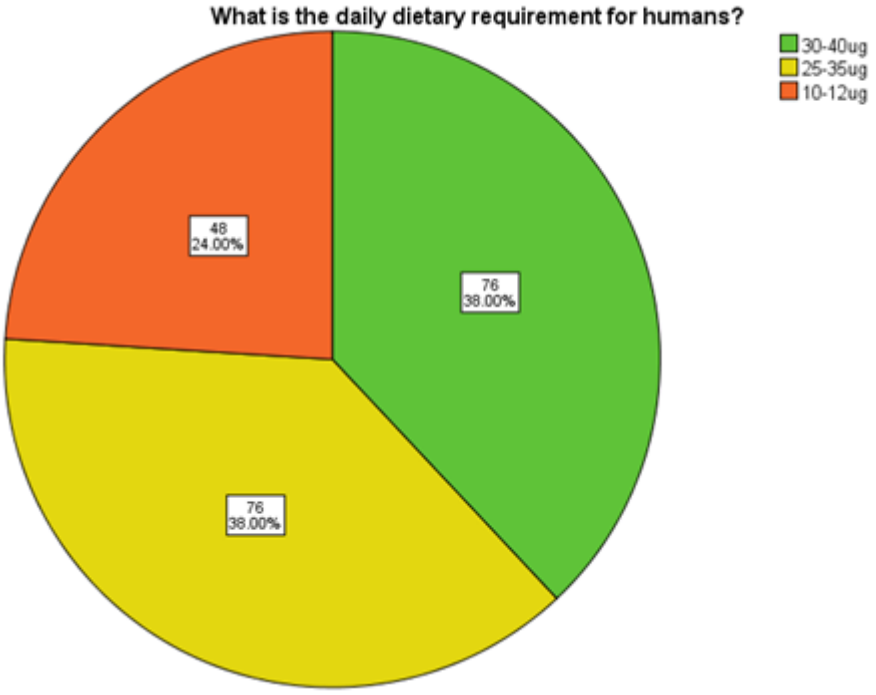
Graph 1: The pie chart showing distribution of study population who were aware of Nickel hypersensitivity. About 73% know about Nickel hypersensitivity and 54% gave negative responses



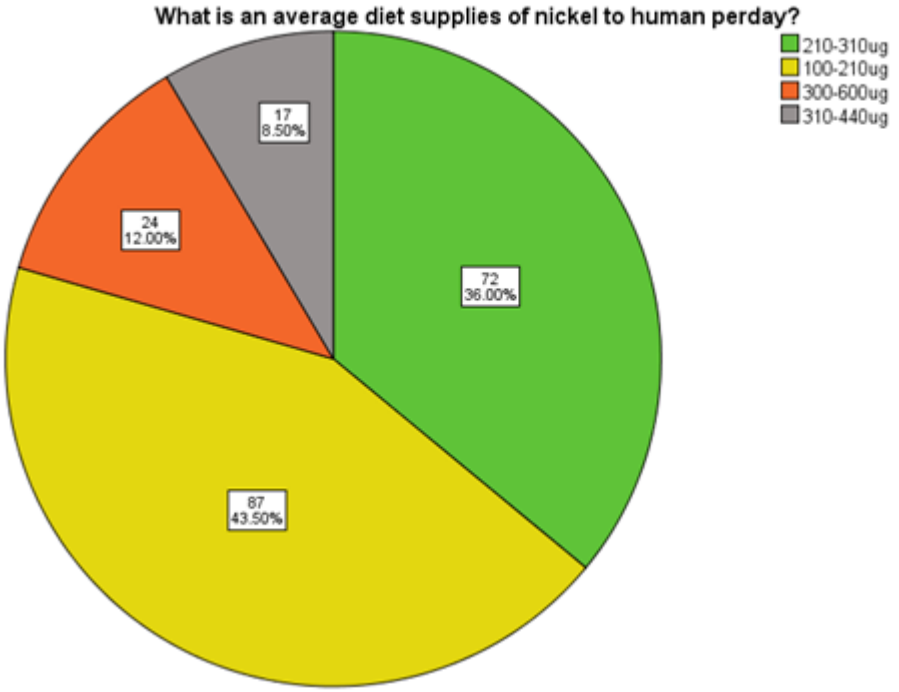
Graph 2: The pie chart showing distribution of study population who were aware that Nickel hypersensitivity is one of the causes for allergic contact dermatitis. About 74.5% of students gave positive responses.



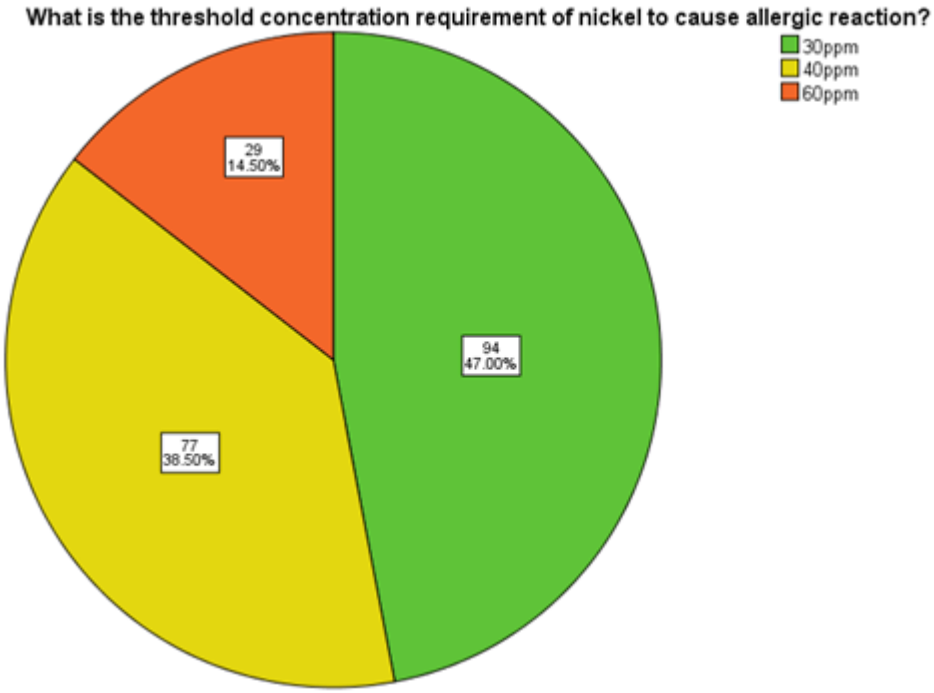
Graph 3: The pie chart showing distribution of study population who were aware of Nickel being one of the components used to make orthodontic wires. About 55.50% of them gave positive responses.



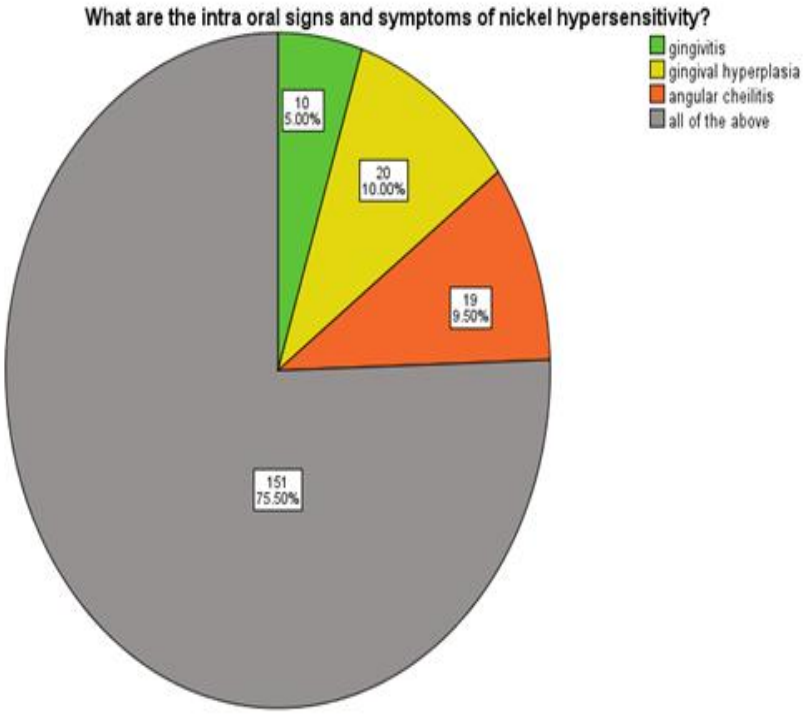
Graph 4: The pie chart showing distribution of study population who were asked about the daily dietary requirements of nickel for humans. About 38% of them answered both 30-40 ug and 25-35 ug being the daily dietary requirements for humans.



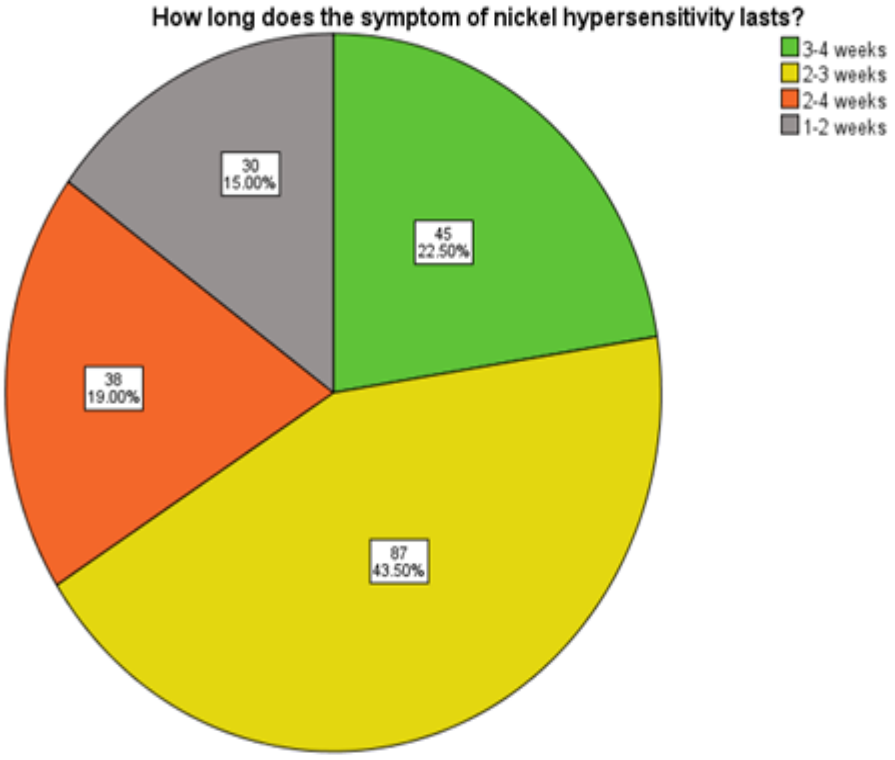
Graph 5: The pie chart showing distribution of study population who were asked about the average diet supply of nickel to humans per day. Only about 12% of students gave positive responses



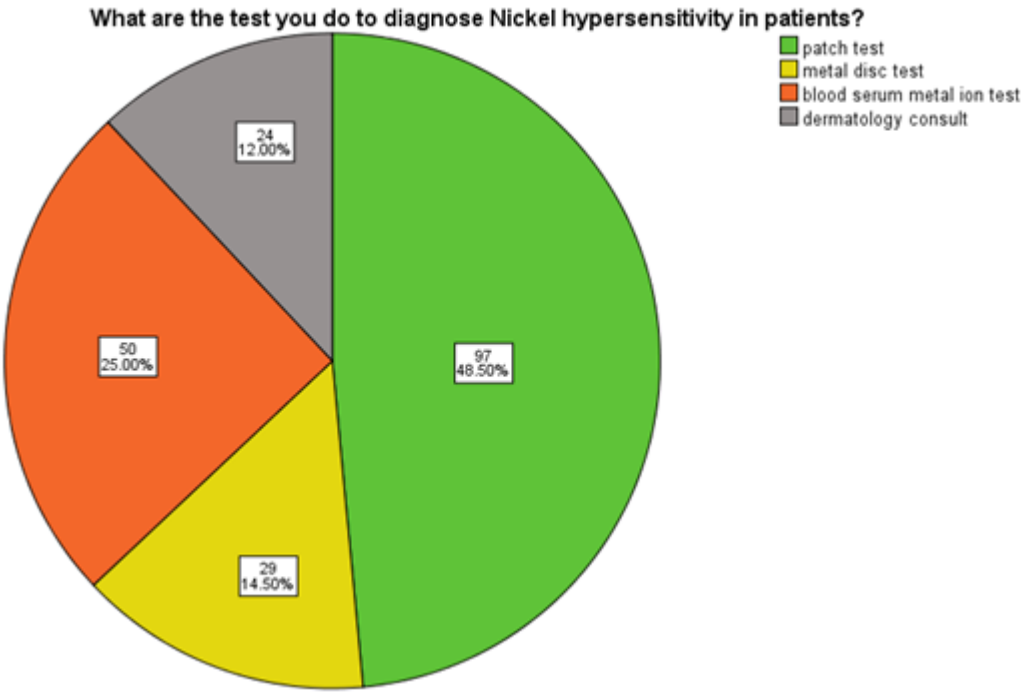
Graph 6: The pie chart showing distribution of study population who were asked about the threshold concentration of Nickel to cause allergic reactions. About 94% of students gave positive responses.



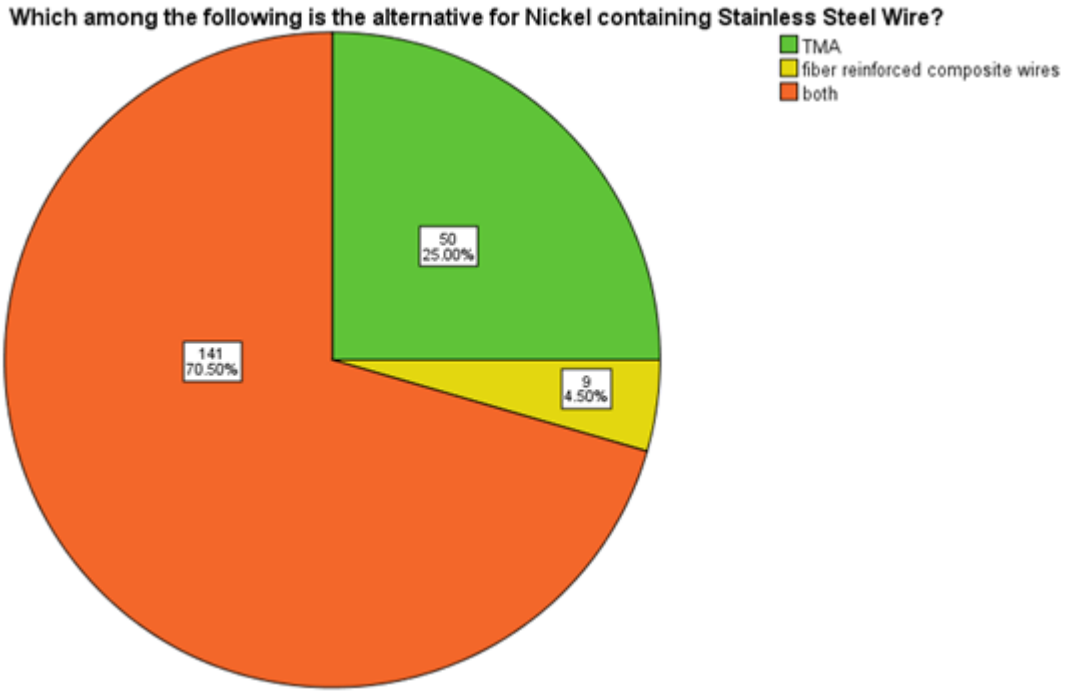
Graph 7: The pie chart showing distribution of study population who were aware of the intra oral symptoms of Nickel hypersensitivity. About 75.50% of students know about the intra oral symptoms of Nickel hypersensitivity.



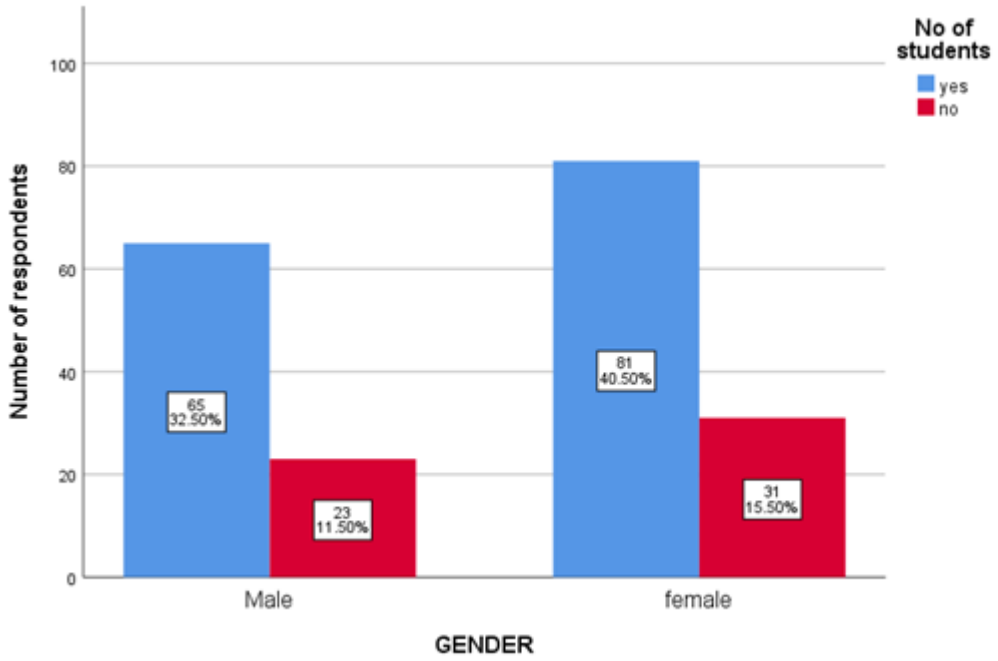
Graph 8: The pie chart showing distribution of study population who were asked about the duration of Nickel hypersensitivity symptoms to last. Only about 19% of the students gave positive responses.



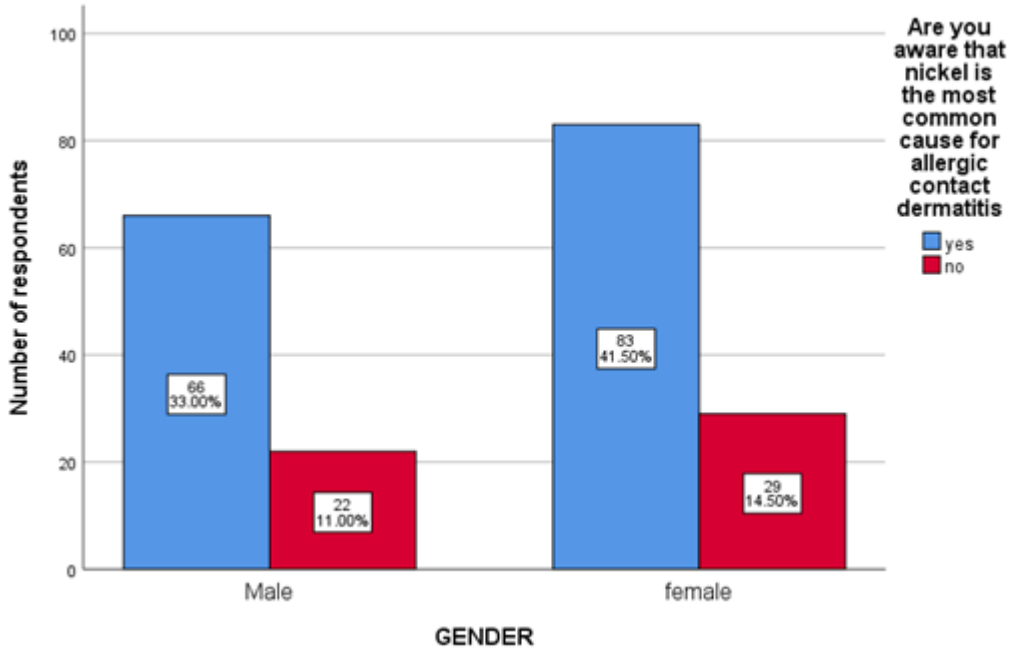
Graph 9: The pie chart showing distribution of study population who were aware about the test used to diagnose Nickel hypersensitivity. About 48.50% know about the diagnostic test for Nickel hypersensitivity.



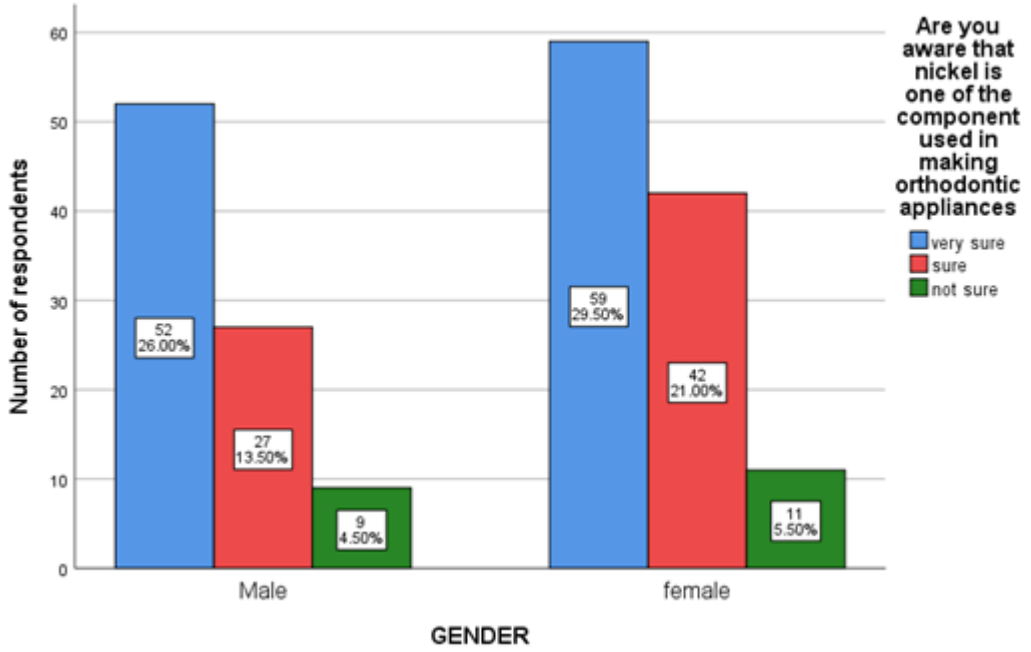
Graph 10: The pie chart showing distribution of study population who were aware about the alternative for Nickel containing stainless steel wire. About 70.50% of the students gave positive responses.



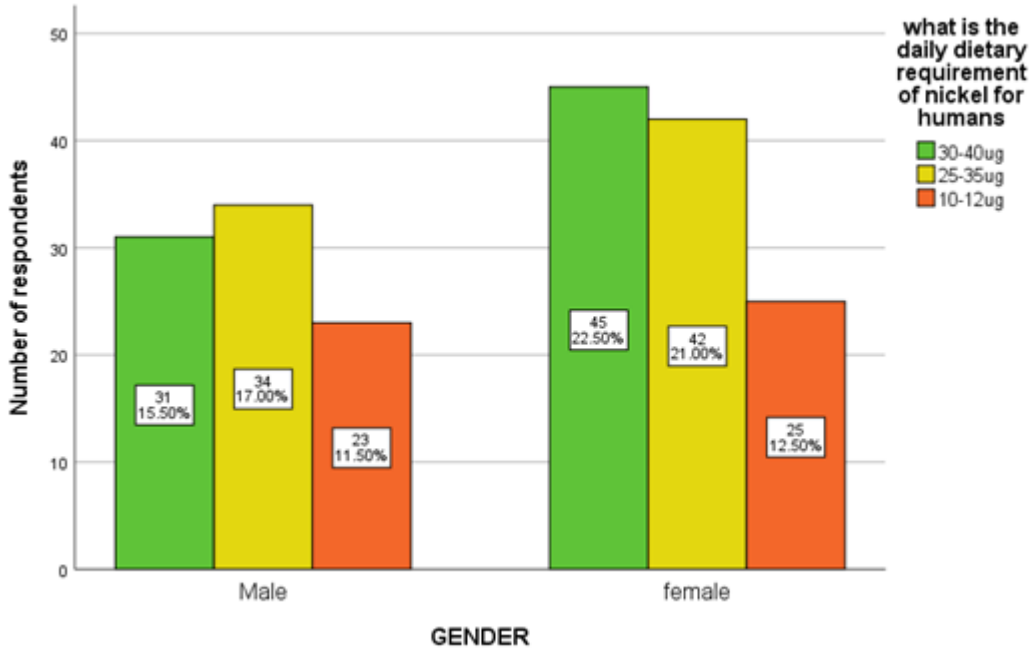
Graph 11: The bar graph showing the association between gender and awareness about Nickel Hypersensitivity. Higher number of females reported to know about Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about Nickel Hypersensitivity. (Chi – Square, p value: 0.807 (p>0.05 statistically non significant))



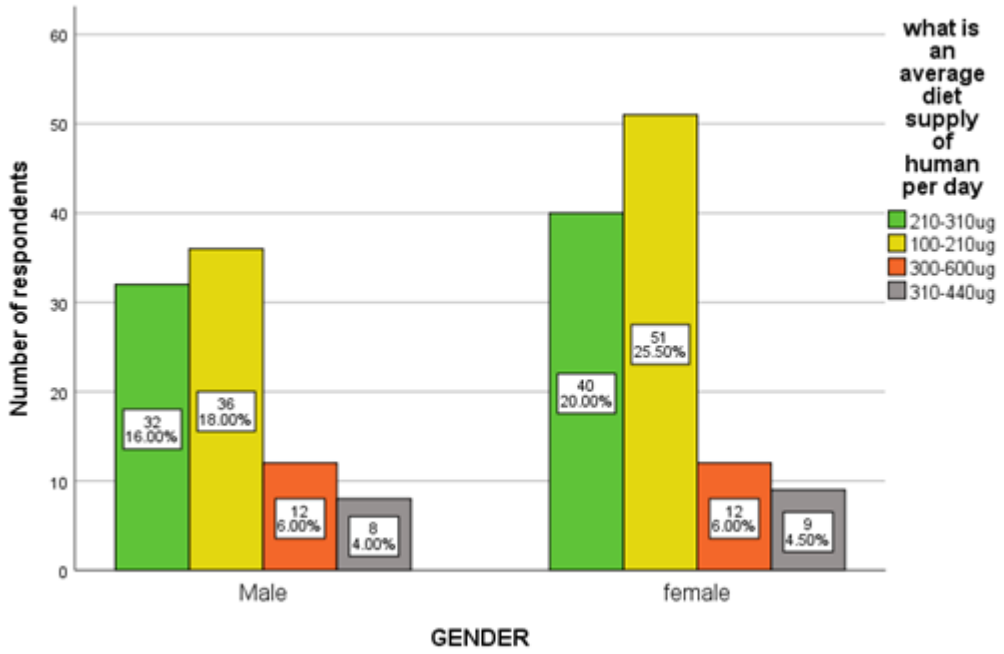
Graph 12: The bar graph showing the association between gender and awareness about Nickel Hypersensitivity being one of the common causes for allergic contact dermatitis. It is observed that a higher number of females reported to know about Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about Nickel Hypersensitivity being one of the common causes for allergic contact dermatitis. (Chi – Square, p value: 0.886(p>0.05 statistically non significant))



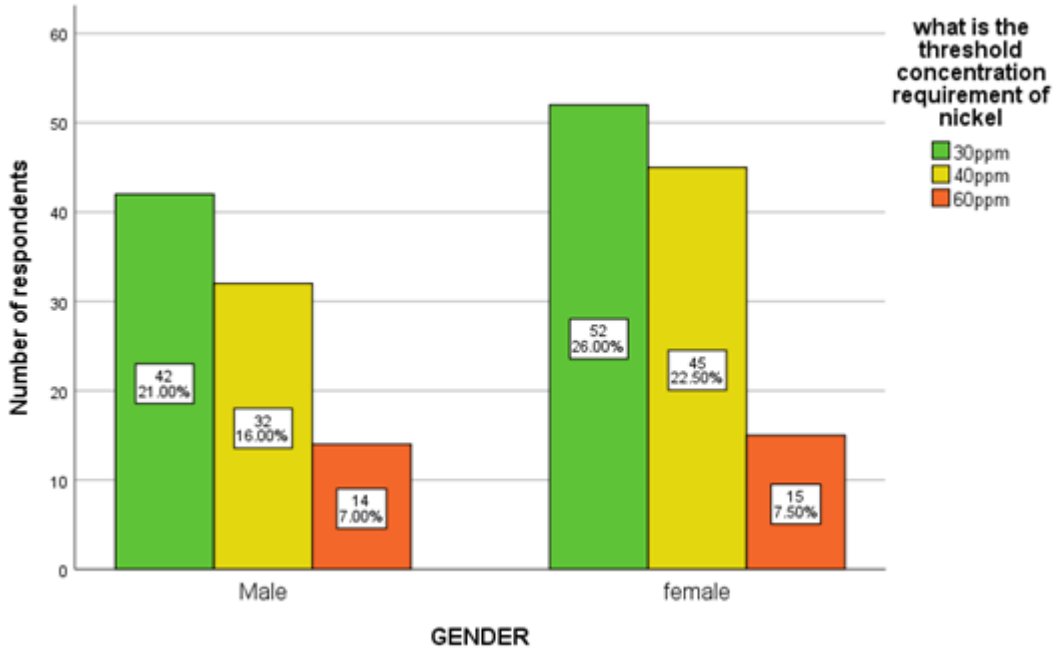
Graph 13: The bar graph showing the association of gender and awareness about Nickel being one of the components used in making orthodontic appliances. It is observed that a higher number of females reported to know about Nickel being one of the components used in making orthodontic appliances when compared to males. There was no significant difference between the gender and awareness about Nickel being one of the components used in making orthodontic appliances. (Chi – Square, p value: 0.595(p>0.05 statistically non significant))



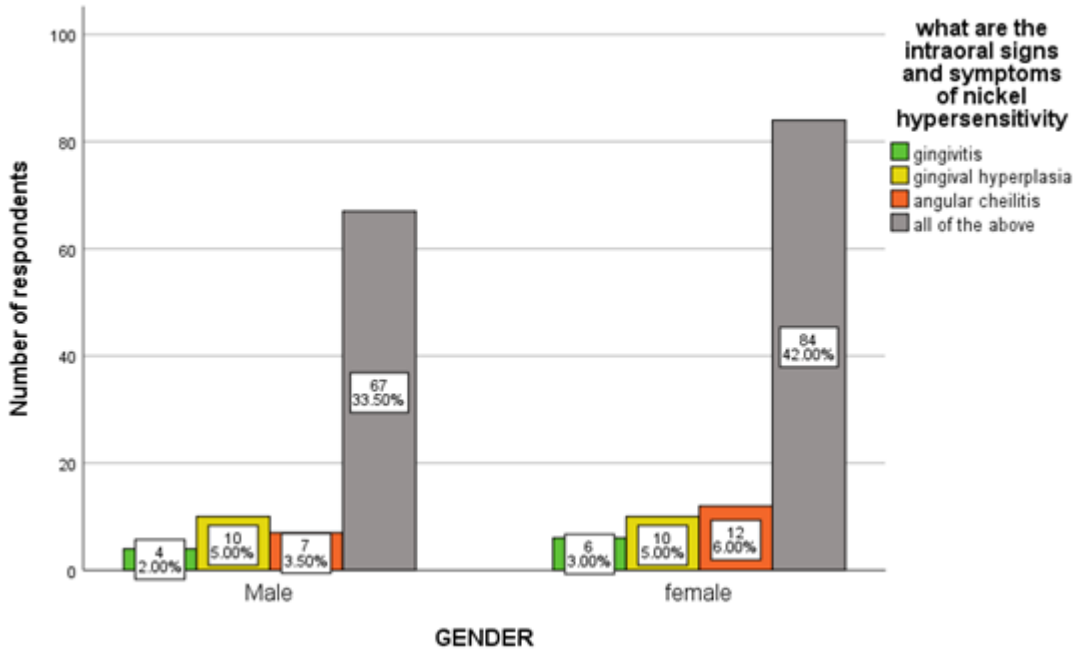
Graph 14: The bar graph showing the association of gender and awareness about the daily dietary requirement of Nickel for humans. It is observed that a higher number of females reported to know about the daily dietary requirement of Nickel for humans when compared to males. There was no significant difference between the gender and awareness about the daily dietary requirement of Nickel for humans. (Chi – Square, p value: 0.729(p>0.05 statistically non significant))



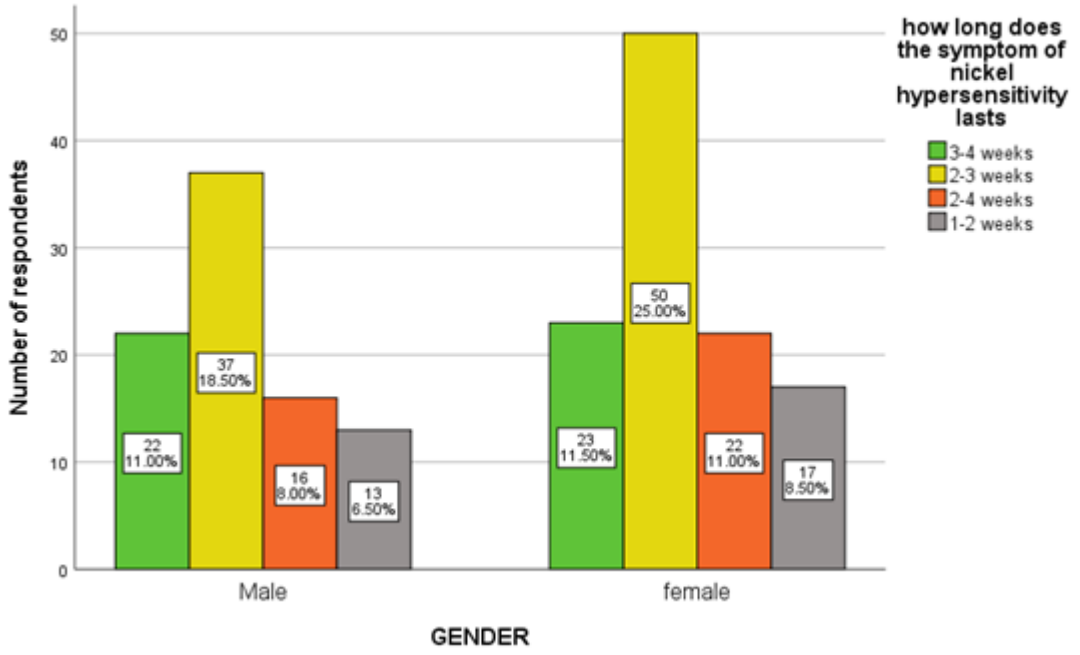
Graph 15: The bar graph showing the association of gender and awareness about the average diet supply of Nickel for humans per day. It is observed that a higher number of females reported to know about the average diet supply of Nickel for humans per day when compared to males. There was no significant difference between the gender and awareness about the average diet supply of Nickel for humans per day. (Chi – Square, p value: 0.882(p>0.05 statistically non significant))



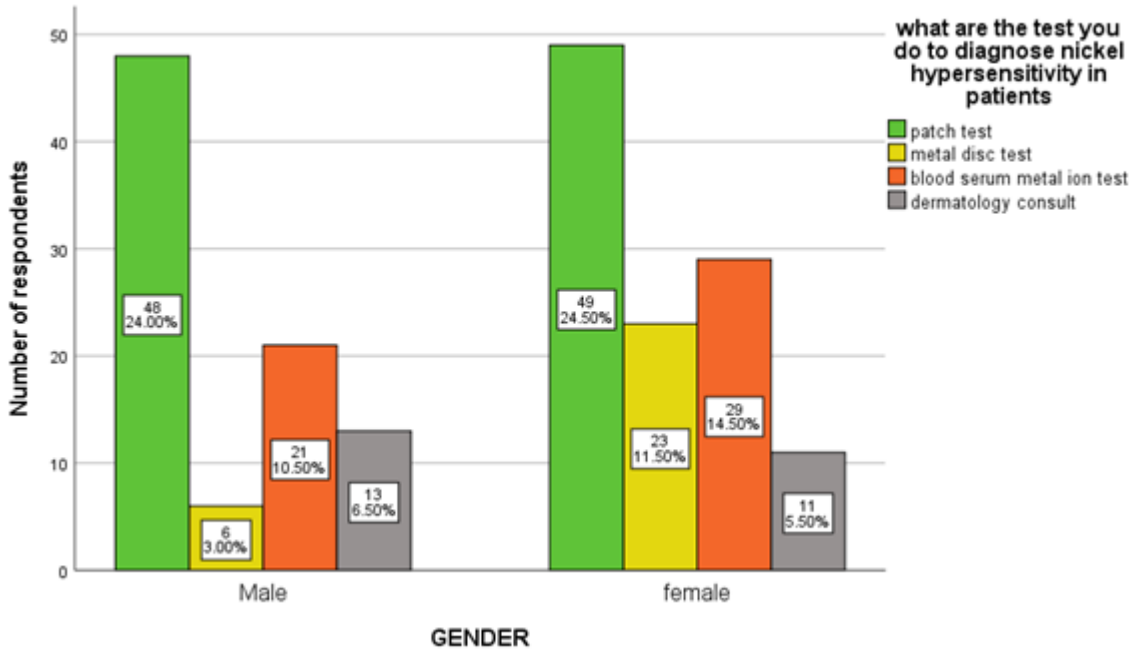
Graph 16: The bar graph showing the association of gender and awareness about the threshold concentration requirement of Nickel. It is observed that a higher number of females know about the threshold concentration requirement of Nickel when compared to males. There was no significant difference between the gender and awareness about the threshold concentration requirement of Nickel. (Chi – Square, p value: 0.811(p>0.05 statistically non significant))



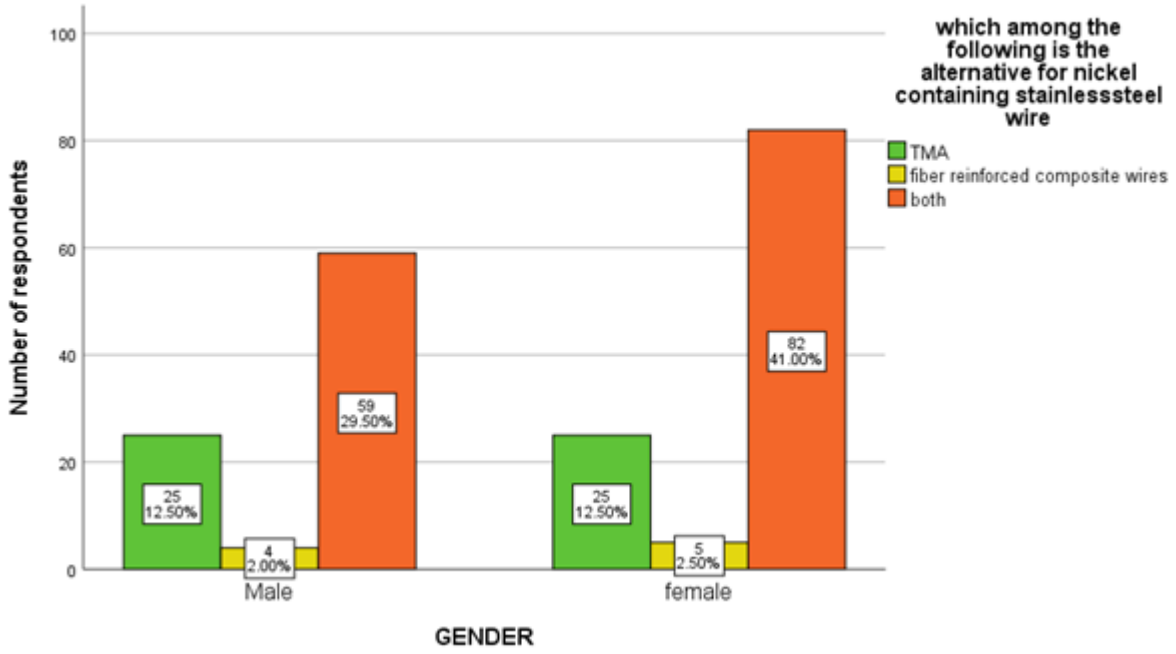
Graph 17: The bar graph showing the association of gender and awareness about the intraoral signs and symptoms of Nickel Hypersensitivity. It is observed that a higher number of females know about the intraoral signs and symptoms of Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about the intraoral signs and symptoms of Nickel Hypersensitivity. (Chi – Square, p value: 0.859(p>0.05 statistically non significant))



Graph 18: The bar graph showing the association of gender and awareness about the longevity of the symptoms of Nickel Hypersensitivity. It is observed that a higher number of females know about the longevity of the symptoms of Nickel Hypersensitivity when compared to males. There was no significant difference between the gender and awareness about the longevity of the symptoms of Nickel Hypersensitivity.(Chi – Square, p value: 0.902 (p>0.05 statistically non significant))



Graph 19: The bar graph showing the association of gender and awareness about the test used to diagnose Nickel Hypersensitivity. It is observed that a higher number of females know about the test used to diagnose Nickel Hypersensitivity when compared to males. There was significant difference between the gender and awareness about the test used to diagnose Nickel Hypersensitivity. (Chi – Square, p value: 0.034 (p<0.05 statistically significant))



Graph 20: The bar graph showing the association of gender and awareness about the alternative used for Nickel containing stainless steel wire. It is observed that Higher number of females know about the alternative used for Nickel containing stainless steel wire when compared to males. There was no significant difference between the gender and about the alternative used for Nickel containing stainless steel wire (Chi – Square, p value: 0.607(p>0.05 statistically non significant))

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; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai et al., 2019; Sridharan et al., 2019; Vijayashree Priyadharsini, 2019; Mathew et al., 2020)

LIMITATIONS

The main limitations of this study was limited sample size and it was confined to limited geographical population. For further scope of the study increased sample size with inclusion of varied population ethnicity would give better results.

CONCLUSION

Dental students in this study have a good level of knowledge and positive attitude towards nickel hypersensitivity in patients. However, the knowledge acquired must be implemented in their daily practice and provide the better treatment required for the patients. Continuing education programs and refreshing courses regarding nickel hypersensitivity in patients are necessary to update the knowledge of dental practitioners.

AUTHORS CONTRIBUTION

First author, sandhya performed the data collection by reviewing patient details, filtering required data, analysing and interpreting statistics and contributed to manuscript writing.
Second author, Dr. Remmiya Mary Varghese contributed to conception of study title, study design, analysed the collected data, statistics and interpretation and also critically revised the manuscript.
Third author, Dr. Senthil Murugan P participated in the study and revised the manuscript. All the three authors have discussed the results and contributed to the final manuscript.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests.

REFERENCE

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