Innovation in Artificial Organs and Their Applications in Medical Field - A Survey among Dental Students

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ABSTRACT:

BACKGROUND:

Artificial organ is a technique implementing and integrating a man- made organ in place of natural organs. It is one of most important and essential innovations in health care in recent days. The aim of the study is to analyse the awareness of innovations in artificial organs and their applications in the medical field among dental students.

MATERIALS AND METHODS:

Self administered questionnaires were designed based on Knowledge, Attitude and Practice. The questionnaires were distributed through an online platform. The study population included people belonging to the age group of 18 - 24 years and circulated among dental college students in the year 2020. The responses were collected and statistically analyzed using SPSS software.

RESULTS AND CONCLUSION:

The survey results were collected and data was analysed and the Results showed that more than fifty percent of the participants were aware about the existence and usage of artificial organs and its implications in the medical field and a quite considerable amount of more than twenty five percent of students provided with affirmative responses to innovations in artificial organs. More than seventy five percentage of the participants were also aware that artificial organs can also be applied in the field of dentistry. The results conclude that modern day health care students have enough knowledge, attitude and awareness about artificial organs in the field of medicine and dentistry.

KEYWORDS: Artificial organs; Medical Innovation; life saving technique; Organ rejection.

INTRODUCTION:

There are many achievements in the medical field. One among those are artificial organs, tissue generation and replacement. Advancements in genetic engineering, nanotechnology, proteomics, artificial intelligence will help in future organ designs (Malchesky, 2001). Manufacturing of organs can be divided by parameters like handmade, fully automated and partially automated.

Failure of the organ may lead to severe issues in our body and finally leads to severe issues in our body and finally leads to death. Some advances are made in the medical field to meet the failure in organs, i.e. manufacturing of artificial and bio- artificial organs. Commonly, artificial organs are the device which can be integrated into a body in place of organs present naturally (Wang, 2019).

As medical technology is the combination of both engineering and medicine, the knowledge about artificial organs should be widely spread (Remuzzi, 2017). Artificial organs are developed to replace failed organs. It brought development in stem cell biology, tissue engineering and molecular immunology. These innovations are made to increase the survival rate of an individual and to improve the quality of life of severely ill patients. Insulin Pumps, Intravenous oxygenators, Pacemakers, Ventricular - assist devices, Internal defibrillators are the devices which reached a pinnacle in the field of medicine (Niklason and Langer, 2001).

Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Ariga*et al.*, 2018; Basha, Ganapathy and Venugopalan, 2018; Hannah *et al.*, 2018; Hussainy*et al.*, 2018; Jeevanandan and Govindaraju, 2018; Kannan and Venugopalan, 2018; Kumar and Antony, 2018; Manohar and Sharma, 2018; Menon *et al.*, 2018; Nandakumar and Nasim, 2018; Nandhini, Babu and Mohanraj, 2018; Ravinthar and Jayalakshmi, 2018; Seppan*et al.*, 2018a; Teja, Ramesh and Priya, 2018; Duraisamy*et al.*, 2019; Gheena and Ezhilarasan, 2019; Hema Shree *et al.*, 2019; Rajakeerthi and Ms, 2019; Rajendran *et al.*, 2019; Sekar*et al.*, 2019a; Sharma *et al.*, 2019; Siddique *et al.*, 2019; Janani, Palanivelu and Sandhya, 2020; Johnson *et al.*, 2020a; Jose, Ajitha and Subbaiyan, 2020).

MATERIALS AND METHODS:

Self- administered questionnaires were designed based on Knowledge, attitude, perception and practice. The questions were circulated to the age group of 18-24 years to 100 undergraduate college students in the year 2020. It was circulated using google forms and a list of output variables were included. Descriptive variables like age, years of study, gender and explanatory variables like personality traits, knowledge, attitude and practice were also included. Each output variable was collected as ordinal data and the collected data were represented as pie charts. A statistical test was done using software SPSS. Statistical test used descriptive analysis and frequency percentage. The present study was done based on scientifically sounded protocols and got scientific review board approval . Exclusion criteria of this study are participants not willing to participate and medically compromised patients. Some of the inclusion criteria are participants above18 years of age, dental college students. Chi-Square analysis was performed and p<0.05 was considered as statistically significant.

RESULTS :

In the current study, the questionnaires were prepared and circulated on the basis of Knowledge, Attitude, perception and practice. It is important to know about the essential uses of artificial organs in the medical field. Knowing about the Innovations and scope of artificial organs, helps to acquire knowledge about artificial organs (Scribner, 1964).

Survey on knowledge and awareness on innovations in artificial organs and their applications in the medical field consists of the study population of the age group 18 to 24 in which 45.63% of them are male and 54.37 % of them are female (figure 1). 41.75 % of the population suggested that they have a neutral image about artificial organs (figure 2). 60.19% of the population think that artificial organs minimize the number of organ donors (figure 3). 60.19 % of the respondents employed that artificial organs increase the survival rate when compared to the other methods (figure 4). When compared to other technologies like Xero Plantations most of the population that is 27.18% of them prefer artificial organs (figure 6). When the participants were enquired about the innovations in artificial organs, and which is the most common artificial organ in frequent use nowadays 47.57 % of the population implied that the lungs are the most needed artificial organs (figure 7). 58.25 % of them have a view that organ rejection is reduced due to artificial organs (figure 8). 41.75 % of the population responded that other problems like immunological problems are the major disadvantage and risk of the artificial organs (figure 9). 43.69 % of the population responded

that artificial organs are more of a threat than the opportunity in the medical field (figure 10). 60.19% of the respondents responded that implanting artificial organs would affect people psychologically and it may lead to depression (figure 11). 51.46 % of the population have the same idea that tissue engineering and artificial organs are related to each other (figure 13). 54.37% of the population employed the cultivation and implanting of artificial organs as an easier method (figure 15). 62.14% of them implied that implanting artificial organs is a cost effective technique (figure 16). 75.73 % of the population says that artificial organs are possible in dentistry (figure 18).

We have seen the association between the gender and knowledge on artificial organs increases the survival rate (figure 5), awareness on artificial organs affects the individual psychologically (figure 12)awareness on artificial organs are related to tissue engineering (figure 14), awareness on artificial organs are cost effective (figure 17), knowledge on artificial organs in dentistry (figure 19).

Our study showed higher prevalence of adequate knowledge regarding artificial organs when compared to the studies reported earlier. People aren't only preferring artificial organs for organ transplantation, they are also aware and prefer methods like xero plantation, organ donation, regenerative medicine and tissue engineering.

DISCUSSIONS:

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; VijayashreePriyadharsini, SmilineGirija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai*et al.*, 2019; Sridharan *et al.*, 2019; VijayashreePriyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021))

Research done by Malchesky reported that 51.9 % of them have a view that artificial organs increase the survival rate, whereas in current study it is reported that 60.19 % of the respondents responded that artificial organs increase the survival rate (Malchesky, 2001). Jonathan in his study reported that 72 % of the population suggested that lung is the most commonly used artificial organ nowadays supporting that present study also implies that lung is the most important artificial organ you commonly used nowadays (Haft *et al.*, 2005). Taimur Saleem in his study reported that 35 % of the population suggested that bodily weakness is the most common risk in organ transplantation which is supporting the current study. Whereas the present study suggested that immunological problems are the major risk in artificial organs (Saleem *et al.*, 2009). A study done by RaktimPratimTamuli reported that 45 % of the population employed that organ donation has increased nowadays (Saikia, Tamuli and Sarmah, 2019). P. Burra in his study reported that 96% of the population had suggested that artificial organs are there to help mankind, whereas in current study, 22.33% of the population reported that they have a good image about artificial organs and they are innovated to help mankind (Burra *et al.*, 2005; Mineshima, 2005).

Previously our team had conducted numerous clinical trials and (Sriram, Thenmozhi and Yuvaraj, 2015; Thejeswar and Thenmozhi, 2015; Krishna, Nivesh Krishna and Yuvaraj Babu, 2016; Nandhini *et al.*, 2018; Seppan*et al.*, 2018b; Sekar*et al.*, 2019b; Johnson *et al.*, 2020b) lab animal studies (Samuel and Thenmozhi, 2015; Keerthana and Thenmozhi, 2016; Menon and Thenmozhi, 2016; Pratha, AshwathaPratha and Thenmozhi, 2016) and in-vitro studies (Choudhari and Thenmozhi, 2016; Hafeez and Thenmozhi, 2016; Kannan and Thenmozhi, 2016; Subashri and Thenmozhi, 2016) over the past 5 years. Now we are focusing on epidemiological surveys. The idea for this survey stemmed from the current interest in our community.

There were some limitations that should be noted in the study. First the sample size selected was low in number. Response bias and survey fatigue. Second, the selected population was a homogeneous population and it may lead to a hidden agenda. And noteworthy to mention about the future scope of the study. It is believed that in the future artificial organs should not only focus on the development and replacing the natural organs. It should also focus on the artificial organ technologies and therapeutic and preventive medicine.

The current study was done to analyze the knowledge, attitude, practice and awareness in artificial organs in the medical field. The present generation is adapting to a new lifestyle. Due to dietary modifications and lifestyle changes there are a number of disorders that are observed leading to organ destruction and organ failure. Today's generations are addicted to increased usage of phones which is not considered as a healthy lifestyle and it may also lead to brain tumor , Heart diseases, Impaired eye and ear functions. They may face organ failure and need an artificial organ at a very young age. Sometimes it may lead to organ replacement. New scientific innovations are done and many techniques like Xero plantation, tissue engineering, artificial intelligence, artificial and bio artificial organs are invented. Artificial organs play a major role nowadays and it is one of the most important innovations in the medical field.

CONCLUSION:

The survey results were collected and data was analysed and the Results showed that more than fifty percent of the participants were aware about the existence and usage of artificial organs and its implications in the medical field and a quite considerable amount of more than twenty five percent of students provided with affirmative responses to innovations in artificial organs. More than seventy five percentage of the participants were also aware that artificial organs can also be applied in the field of dentistry. The results conclude that modern day health care students have enough knowledge, attitude and awareness about artificial organs in the field of medicine and dentistry.

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AUTHOR'S CONTRIBUTION:

Serial number	Authors name	Contribution
1	Harini	Sequencing alignment, structuring study design and data collection, final approval of the manuscript
2	Dr.Lavanya	Collection of reviews, revising manuscripts and approving manuscripts, final approval of the manuscripts.
3	Ms. Jothi Priya	Drafting manuscript critical, revision of the manuscript and provided grammatical revisions to the manuscript, final approval of the manuscripts.
4	Dr.Preetha	Drafting manuscript, critical region of the manuscript and provided grammatical,revisions to the manuscript, final approval of manuscript.

CONFLICT OF INTEREST: Nil

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LIST OF FIGURE TITLES:

Figure 1	Gender
Figure 2	Image about artificial organs
Figure 3	Artificial organs minimise the number of organ donors
Figure 4	Artificial organ increases the survival rate
Figure 5	Association between gender and artificial organs increases the survival rate
Figure 6	Organ transplantation
Figure 7	Commonly used artificial organ
Figure 8	Artificial organ reduces the organ rejection
Figure 9	Risks caused due to artificial organ
Figure 10	Attitude about artificial organs
Figure 11	Artificial organs affect individuals psychologically
Figure 12	Association between the gender and artificial organs affect individuals psychologically.
Figure 13	Artificial organs are related to issue engineering
Figure 14	Association between gender and artificial organs related to tissue engineering
Figure 15	Implanting artificial organ is an easy method
Figure 16	Artificial organs are cost-effective
Figure 17	Association between gender and artificial organs are cost-effective
Figure 18	Artificial organs are possible in dentistry
Figure 19	Association between the gender and artificial organs are possible in dentistry.
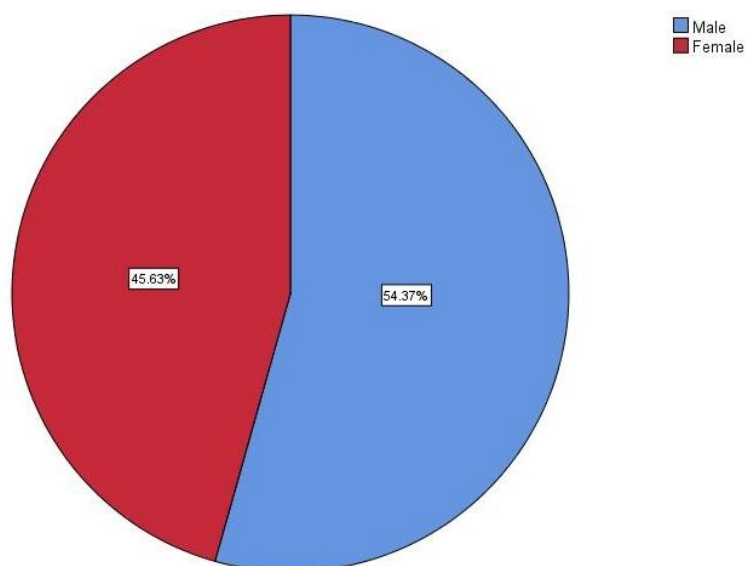
Figure- 1: Pie chart showing percentage distribution of Male and female participants. 54.37% - Majority of the participants were male, 54.37 % (blue), 45.63 % of them are female (red).
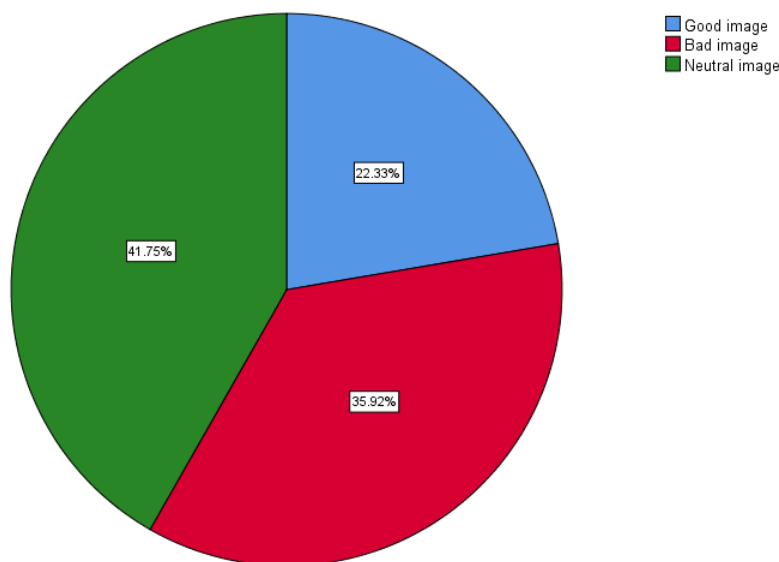
Figure- 2: Pie chart showing percentage distribution of image about artificial organs. 41.75 % of them have neutral image about artificial organs (green). 35.92 % if the participants have a bad image about artificial organs (red). 22.33 % have a good image about artificial organs (blue). Majority of the participants (41.75 %) reported neutral images about artificial organs.
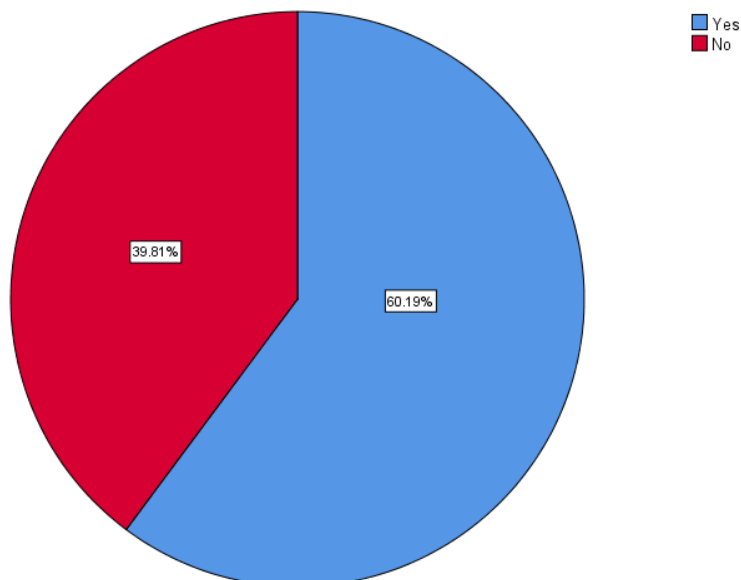
Figure- 3: Pie chart showing percentage distribution of Knowledge about artificial organs minimise the number of organ donors. 60.19 % of them reported that artificial organs minimize the number of organ donors (blue) and 39.81 % of them reported that artificial organs does not minimise the number of organ donors (red). Majority of the participants (60.19 %) reported yes about artificial organs minimizing the number of organ donors.
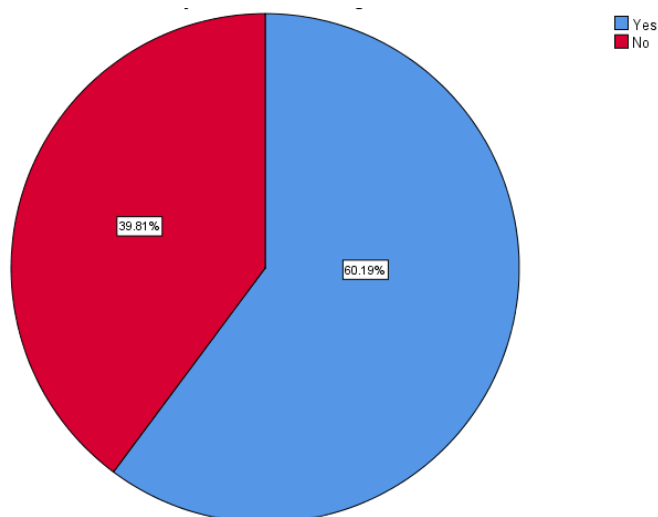
Figure- 4: Pie chart showing percentage distribution of knowledge about artificial organs increases the survival rate. 60.19 % of the participants reported that artificial organs increase the survival rate (blue). Majority of the participants (60.19 %) reported yes about artificial organs increasing the survival rate.
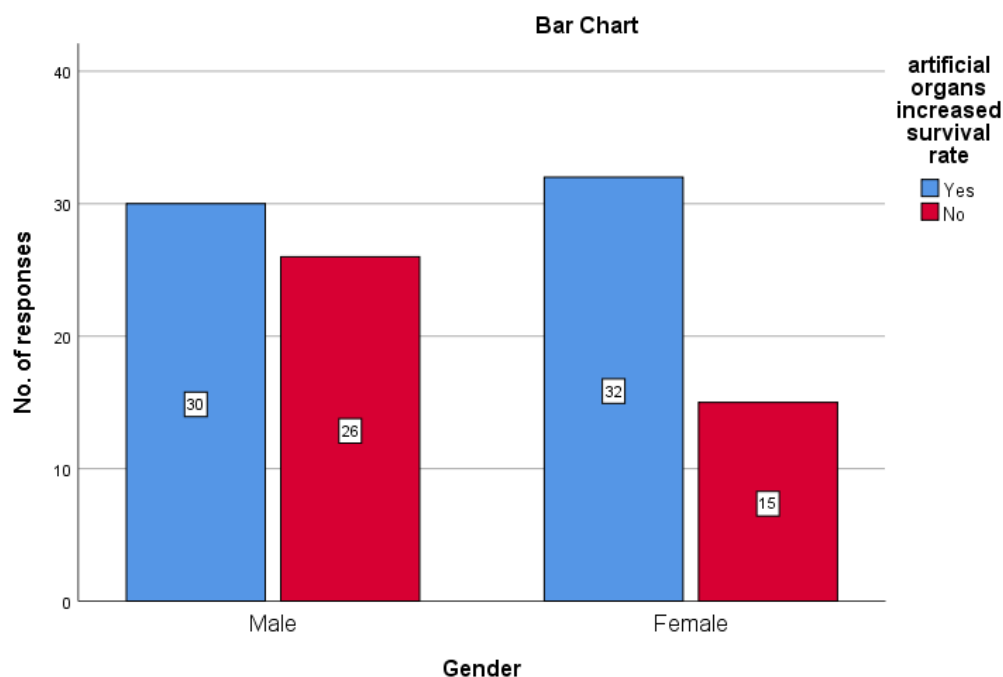
Figure 5: Bar graph represents the association of responses between the gender and artificial organs increases the survival rate. The X axis represents gender and the Y axis represents the number of participants. Majority (32) of the female participants(blue) reported that artificial organs increase the survival rate, followed by 30 male participants reported as yes for the given statement. The Chi square test was analysed to be 2.246 and p value is 0.134 (p>0.05) which was statistically not significant.
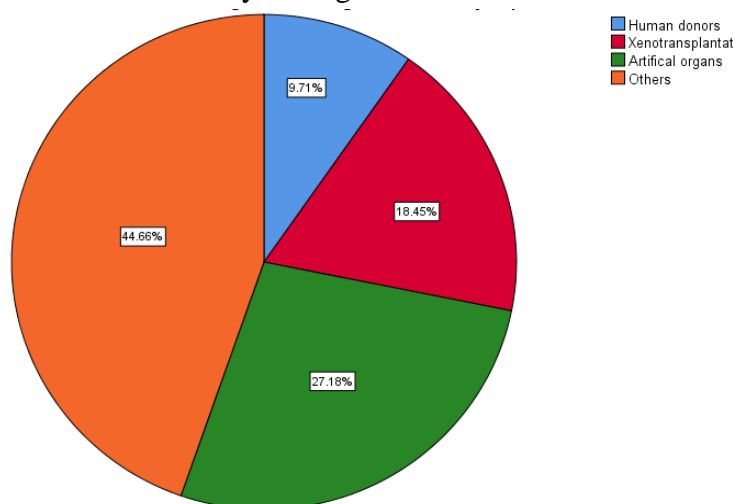
Figure- 6: Pie chart showing percentage distribution of preferences of participants in organ transplantation. 27.18 % of the participants prefer artificial organs (green), 44.66 % of the participants prefer techniques like tissue engineering (orange).18.45 % of the participants prefer xenotransplantation (red), 9.71 % of the participants prefer human donors (blue). Majority of the participants (44.66%) reported as others about organ transplants.
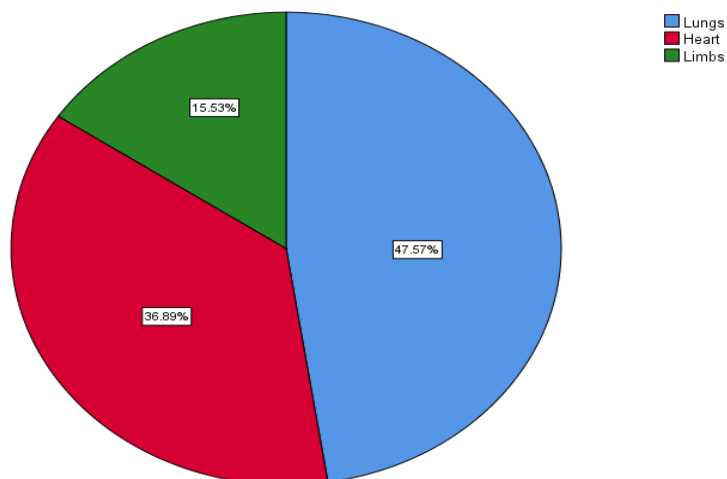
Figure- 7: Pie chart showing percentage distribution of knowledge about artificial organs in common use today. 47.57 % of the population reported that lung is the most commonly used artificial organ nowadays (blue), followed by 36.89% of the participants reported that heart is the most commonly used artificial organ (red). 15.53 % of them reported that limbs are the most commonly used artificial organs (green). Majority of participants (47.57 %) reported that lungs are the most commonly used artificial organs.
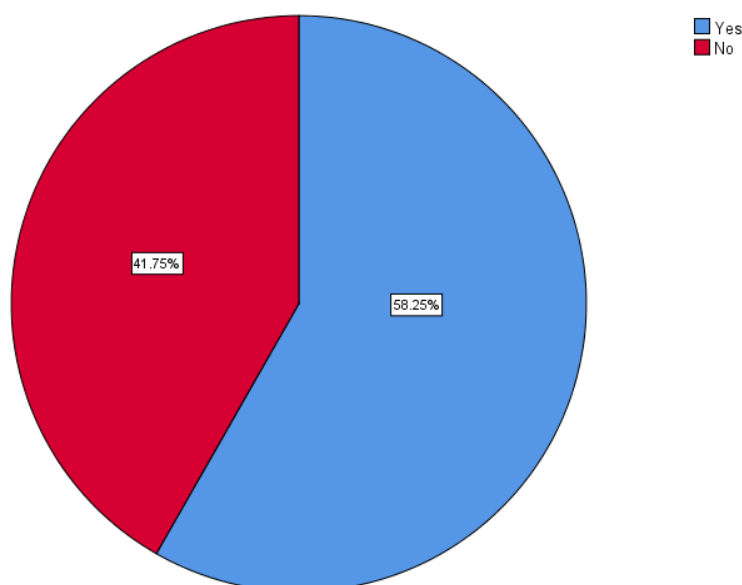
Figure- 8: Pie chart showing percentage distribution of knowledge about organ rejections are reduced due to artificial organs. 58.25 % of the participants reported that organ rejections are reduced due to artificial organs (blue). 41.75 % of the participants reported that organ rejections are not reduced due to artificial organs (red). Majority of the participants (58.25 %) gave an affirmative response about artificial organ decrease organ rejections.
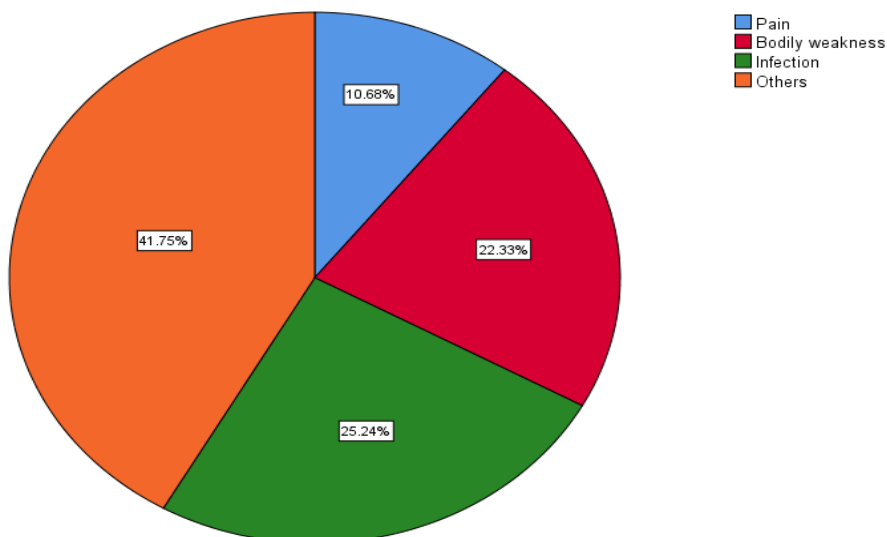
Figure-9: Pie chart showing percentage distribution of knowledge about risks due to artificial organs. Majority of the participants, 41.75 % reported that other risks like immunocompetence is the major problem caused by artificial organs (orange). 25.24 % of the participants reported infection as the major risk (green). 22.33% of the participants reported bodily weakness as the major risk (red). 10.68 % of the participants reported that pain is the major effect caused due to artificial organs (blue). Majority of the participants (41.75 %) reported others about risks about artificial organs.
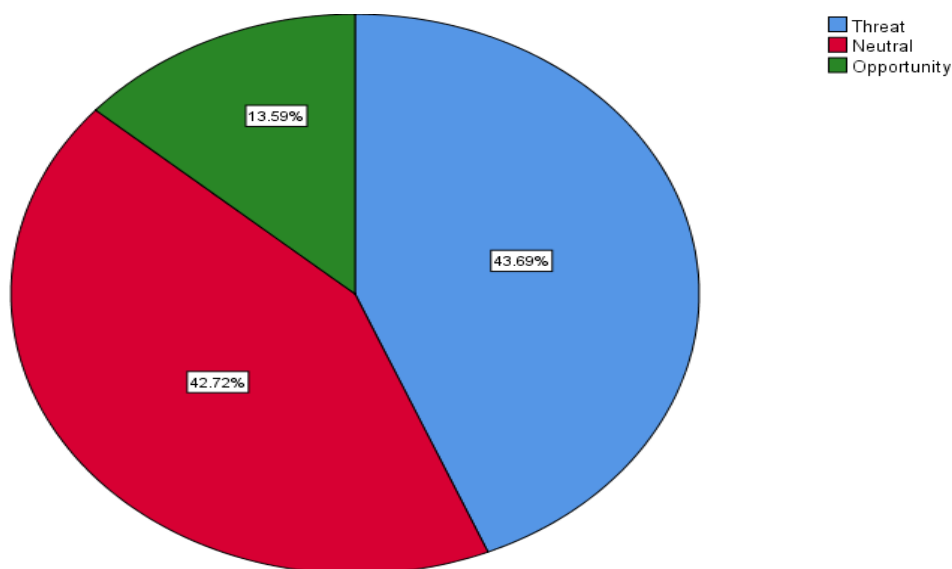
Figure-10: Pie chart showing percentage distribution of attitude about artificial organs in the medical field. 43. 69 % of the participants reported that artificial organs are a threat to humans (blue). 42.72 % of the participants reported that artificial organs are neither a threat nor an opportunity (red), 13.59 % of the population reported that it is an opportunity for humans (green). Majority of the participants (43.69 %) reported that
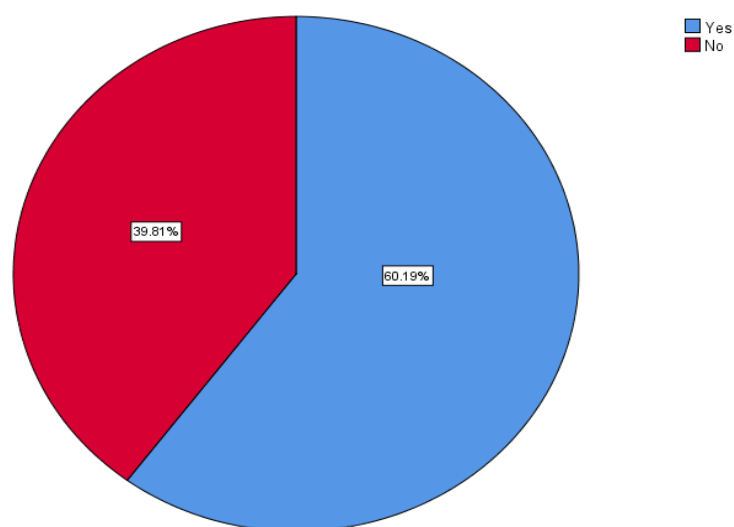
artificial organs as a threat.

Figure- 11: Pie chart showing percentage distribution of knowledge about artificial organs affect the individual psychologically. 60.19% of the participants reported that artificial organs affect the individual psychologically (blue). 39.81 % 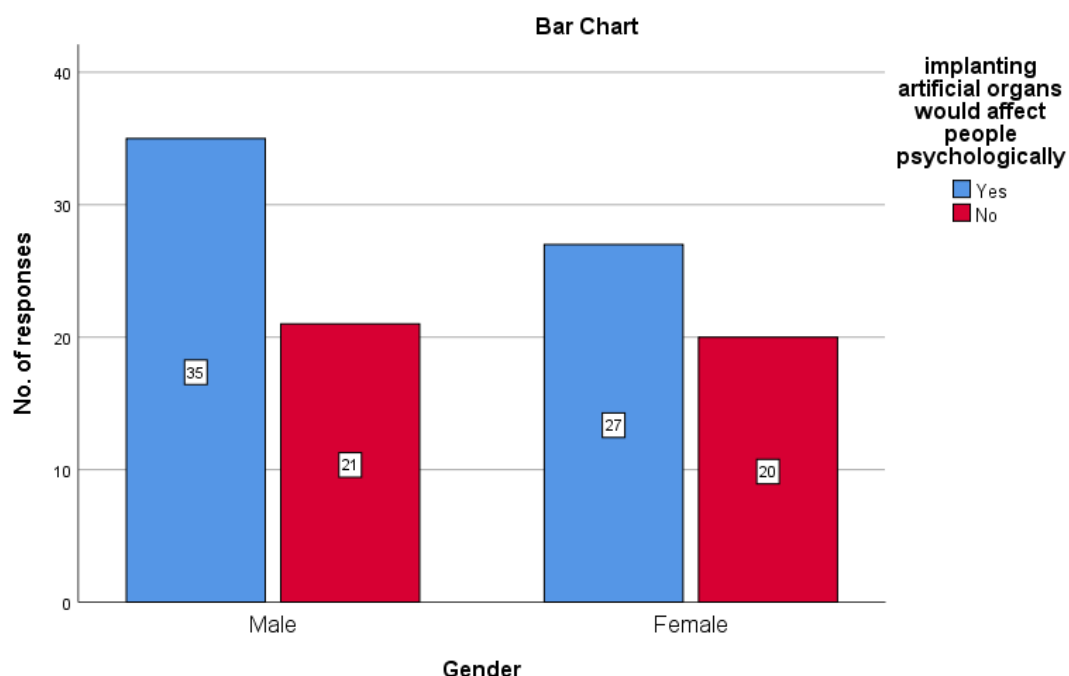of the participants reported that artificial organs do not affect the individual psychologically (red). Majority of the participants (60.19 %) reported that artificial organs affect the individual psychologically.

Figure 12: Bar graph showing association of responses between the gender and artificial organs affects the individual psychologically. The X axis represents gender and the Y axis represents the number of participants. Majority (35) of the male participants (blue) reported that artificial organs affect the individual psychologically, followed by 27 female participants reported yes. The Chi square test was analysed to be 0.272 and p value was 0.602 (p>0.05).
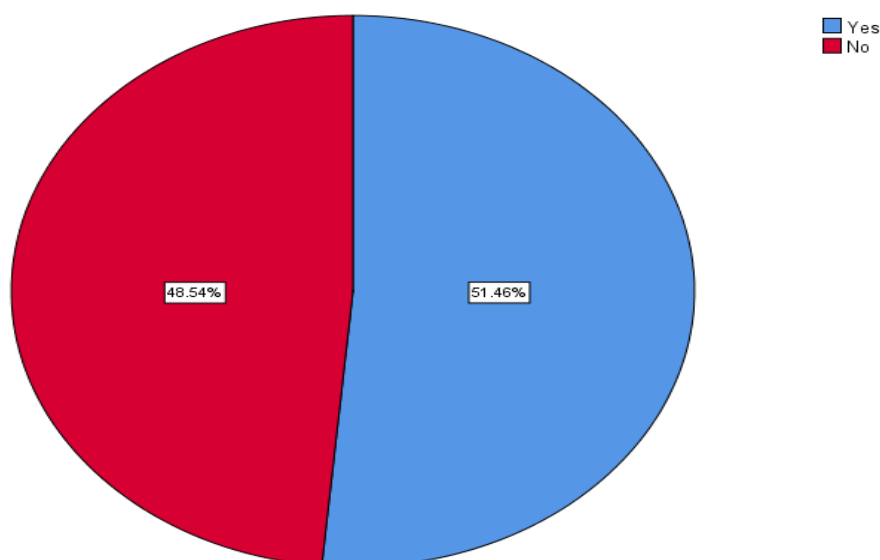
which was statistically significant.

Figure- 13: Pie chart showing percentage distribution of knowledge about artificial organs and tissue engineering are related to each other. 51.46 % of the participants reported that artificial organs and tissue engineering are related to each other (blue). 48.54 % of the participants reported that artificial organs are not related to tissue engineering (red). Majority of the participants (51.46 %) reported that artificial organs and tissue engineering are related to each other.
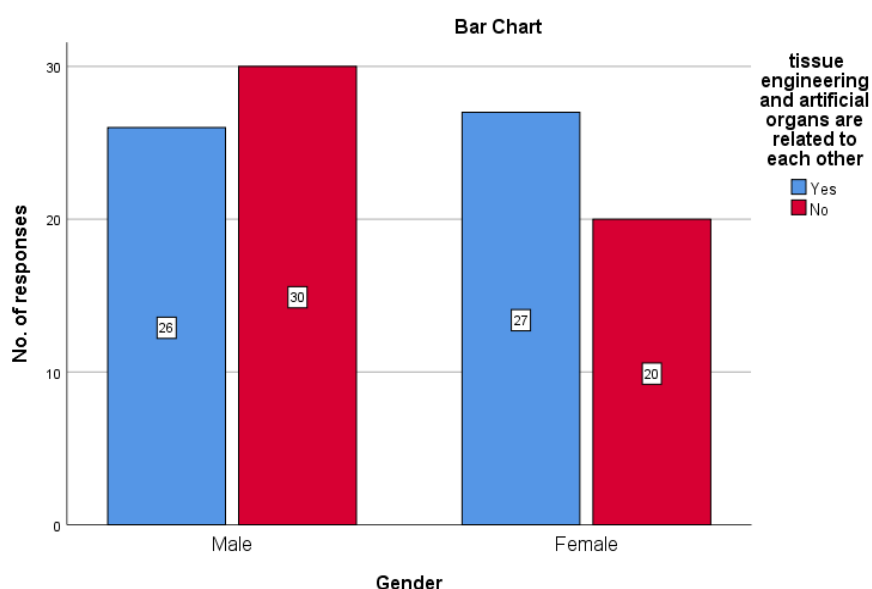
Figure-14: Bar graph showing association of responses between the gender and tissue engineering and artificial organs are related to each other. The X axis represents gender and the Y axis represents the number of participants. Majority (30) of the male participants (red) reported that tissue engineering and artificial organs are related to each other, followed by 27 female participants reported yes. The Chi square test was analysed

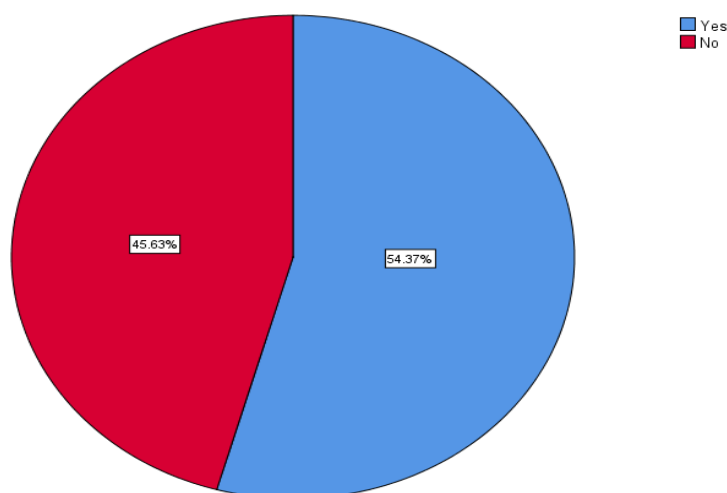to be 1.242 and p value - was 0.265 (p>0.05)] which was statistically not significant.

Figure- 15: Pie chart showing percentage distribution of knowledge that implanting artificial organs is an easier method . 54.37% of the participants reported that implanting artificial organs is an easier method (blue). 45.63 % of the participants reported that implanting artificial organs is not an easier method (red). Majority of the participants (54.37 %) reported that implanting artificial organs is an easier method.
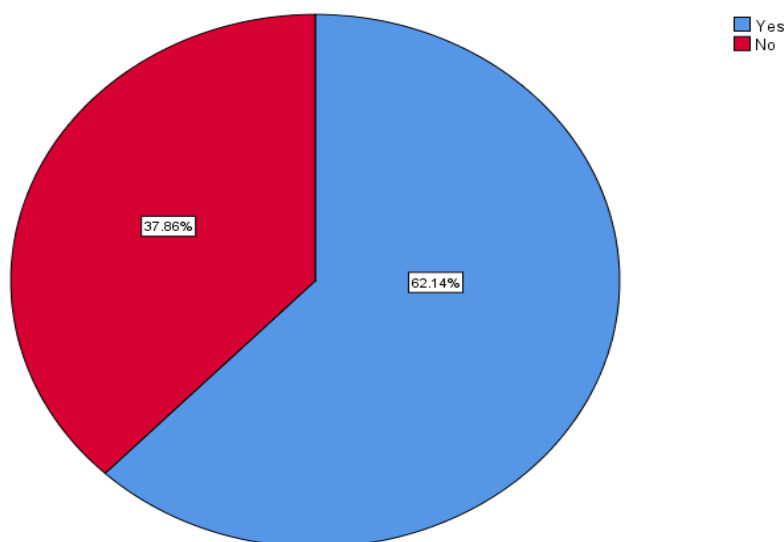

Figure- 16: Pie chart showing percentage distribution of knowledge on artificial organs are cost effective. 62.14 % of the participants reported that artificial organs are cost effective (blue). 37.86 % of the participants reported that it is not cost effective (red). Majority of the participants (62.14%) reported that artificial organs are cost effective.
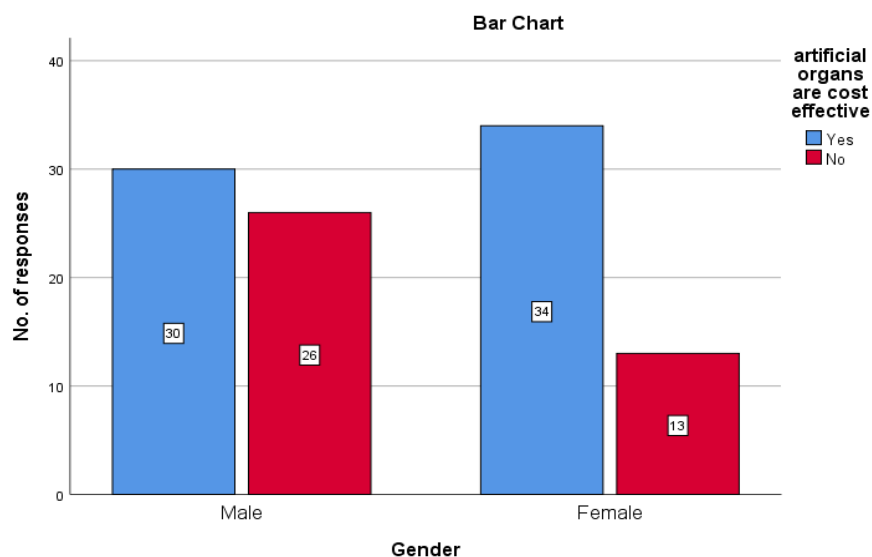
Figure- 17: Bar graph represents the association between the gender and knowledge about artificial organs are cost effective. The X axis represents the gender and the Y axis represents the number of participants. Majority (34) of the female participants (blue) reported that artificial organs are cost effective, followed by 30 male participants reported yes. The Chi square test was analysed to be 3.826 and the p value was 0.050 (p=0.05) which was statistically significant.
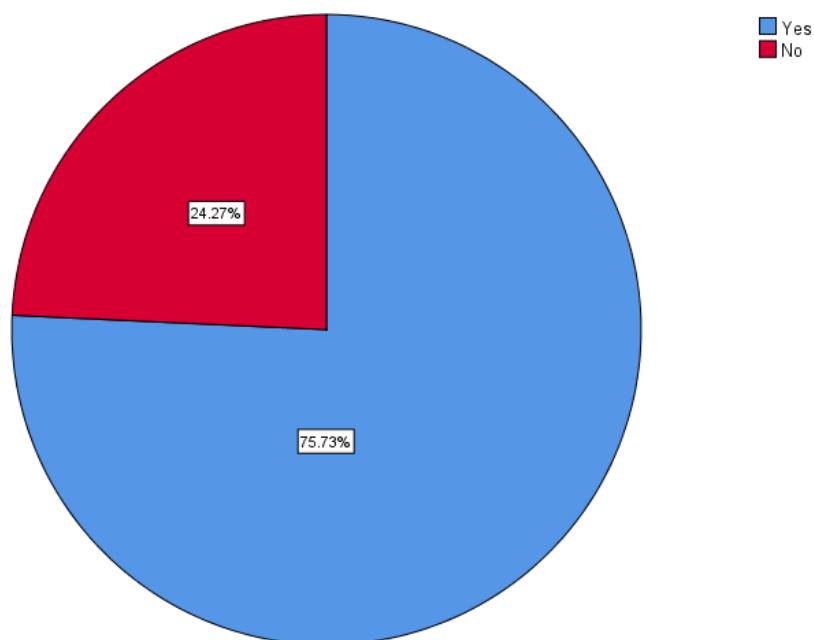

Figure- 18: Pie chart showing percentage distribution of knowledge about artificial organs in dentistry. 75.73% of the participants reported that artificial organs are possible in dentistry (blue). 24.27 % of participants reported that artificial organs are not possible in dentistry (red). Majority of the participants (75.7%) reported that artificial organs are possible in dentistry.
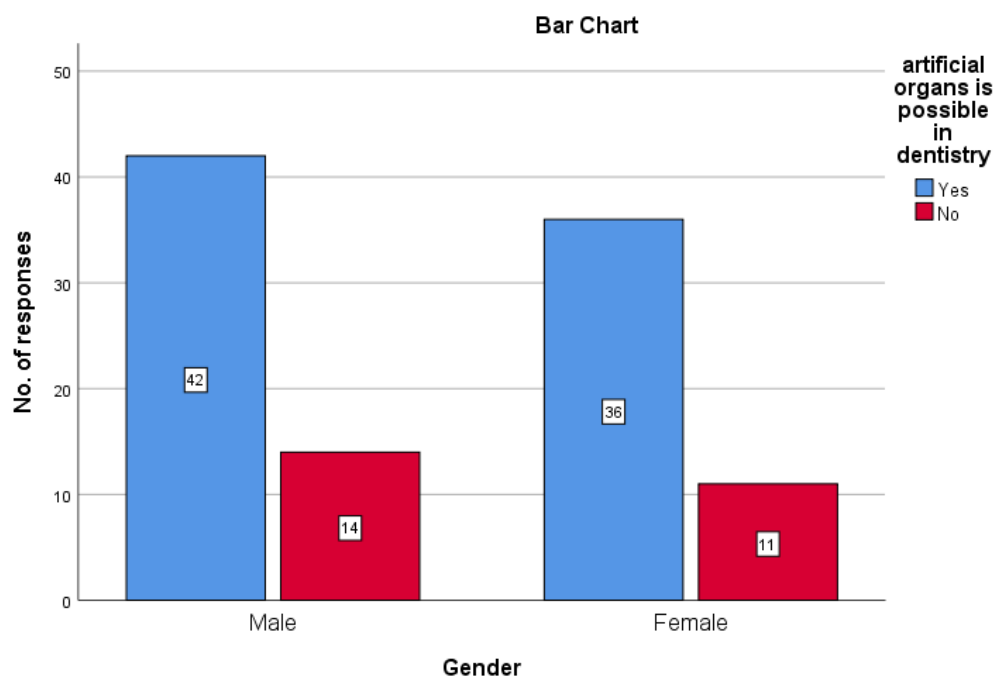
Figure 19: Bar graph showing association of responses between the gender and knowledge about artificial organs in dentistry are related to each other. The X axis represents gender and the Y axis represents the number of participants. Majority (42) of the male participants reported that the artificial organs are possible in dentistry (blue), followed by 36 male participants reported yes. Chi square test analysed to be 0.035 and p value was 0.851 (p>0.05) which was statistically not significant.