

# **PREVALENCE OF DIABETES MELLITUS AND HYPERTENSION AMONG PATIENTS UNDERGOING DENTAL IMPLANT TREATMENT - A HOSPITAL BASED ASSESSMENT.**

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## **Abstract**

*The aim of this study is to retrospectively analyse the prevalence of diabetes mellitus and hypertension among patients undergoing dental implant treatment in a dental hospital. All the patients reported in the month of June 2019 to March 2020 for implant placement was chosen for the study. Implant placement data of patients with diabetes mellitus and hypertension was collected from the dental hospital record system. Result data was tabulated in excel and statistical analysis was done using Statistical Software for the Social Sciences (SPSS) software. The non parametric Chi square test was done for statistical analysis. The prevalence of diabetes mellitus in patients undergoing implant placement is 4.2%, hypertension is 2.2% and coexisting diabetes mellitus and hypertension is 1.7% with a higher*

*incidence in the male population and more common in the age group of 40 to 60 years. Knowledge about the prevalence of these conditions will be helpful to the clinician for proper management setup and precise diagnosis before implant therapy can prevent surgical and postoperative complications resulting in long term success of dental implants.*

**Key words**

***Dental implants, Diabetes mellitus, Hyperglycemia, Hypertension, Osseointegration***

## **I. INTRODUCTION**

A beautiful smile is the result of the harmonious relationship between the components of the oral cavity(1). The replacement of missing teeth with implants for the rehabilitation of complete or partially edentulous patients has become a standard of care in the past two decades which can improve the quality of life(2)(3)(4). Commercially pure titanium endosseous implants have been demonstrated to give success rates of more than 90 per cent over 10 years of follow-up. This success and survival of implants depends on a multitude of patient and implant related factors(5,6).

Both local and systemic factors are said to have an impact on the osseointegration process. Factors such as age, systemic status, smoking, quality of bone, oral hygiene and implant maintenance habits and persisting infection have been previously regarded as the predictors for implant success, survival and failure(7). The success rates of implant surgery has been reported to be complicated or contraindicated by a number of systemic diseases at different levels(8). Few animal and human studies have been performed in order to investigate the possible influence of systemic diseases on implant survival and success rates(9)(10)(11). Some severe systemic conditions representing an absolute contraindication for implant surgery includes myocardial infarction, hemophilia, immunosuppression or any transplantation(12). Diabetes mellitus and hypertension are the most prevalent systemic illnesses in recent days. These conditions are considered as relative contraindications of dental implants.

Diabetes is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both(13). Previously various studies on the pathogenesis(14–17)], systemic diseases(18), and the treatment modalities(19–23) done by our team suggested that periodontitis patients have excessive alveolar bone loss and tooth loss. Concurrently diabetic patients experience periodontitis and early tooth loss when compared with systemically healthy patients(24). A higher failure rate has been seen in diabetic patients with poor metabolic control when compared with systemically healthy individuals due to microvascular complications associated with hyperglycemia(25).

Cardiovascular diseases constitute the main cause of morbidity globally. Some common cardiovascular diseases include hypertension, atherosclerosis, coronary artery disease(26)(27). Cardiovascular diseases may compromise the osseointegration and healing process due to decreased blood flow which reduces the oxygen and supply of nutrients to tissues causing reduction of fibroblast activity, collagen synthesis, capillary growth and macrophage actions favouring infection(28). Diabetes mellitus and hypertension are common diseases that coexist at

a greater incidence in the community(29). Population studies reveal that hypertension is twice as common in diabetic individuals than in those without diabetes mellitus(30)(31). These conditions interfere with the homeostasis of bone remodelling and might be detrimental to the survival of dental implants.

However with proper glycemic and blood pressure control, they have high success rates in implant supported rehabilitations. According to a study held in the year 1999, the success rate of dental implants in patients with diabetes mellitus ranged between 94.3% to 95.7% when followed up to a period of 12 years(32). But the implant procedure failure rates may tend to increase without proper metabolic control in diabetic patients. It has also been proved that, the patients with controlled hypertension do not pose a higher risk of implant failure and have similar success rates as that of non hypertensive patients(33). Despite all the complications these conditions pose, there has been increased preference of dental implants among the clinicians in diabetes and hypertensive patients. Depending upon the individual's level of disease control, implant therapy can be suggested. By knowing the prevalence of these conditions we can give recommendations to the clinicians on proper management protocol before implant procedures. Previously our department has published extensive research on various aspects of prosthetic dentistry (34–43), this vast research experience has inspired us to research about this topic. The aim of this study is to analyse the prevalence of diabetes mellitus and hypertension among patients undergoing dental implant treatment in Saveetha institute of medical and technical sciences (SIMATS).

## **II. MATERIALS AND METHOD**

### **A. Study setting**

The present study was conducted as a retrospective cross sectional study on the prevalence of diabetes mellitus and hypertension among implant patients visiting the Saveetha dental college and hospital, Chennai. The study was reviewed and approved by the institutional review board of SIMATS(ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320).

### **B. Sampling**

A total of 86000 patient records were reviewed for the present study. All the cases reported for implant placement from the month of June 2019 to March 2020 were chosen for the study. Sample size includes 589 patients with 1220 implant placement. The records of all patient data were obtained from the dental hospital record system from initial to last and were arranged in chronological order. All the diabetes mellitus and hypertension report data were properly reviewed and cross verified by another examiner. Gross incomplete data was excluded from the study. Sampling bias was minimised by simple random sampling.

### **C. Data analytics**

The collected data included systemically healthy subjects and those with diabetes mellitus, hypertension patients undergoing implant treatment. Excel tabulation of all the verified data and importing to the Statistical Package for the Social Sciences (SPSS) software of IBM for the

statistical tests was done. The data was subjected to descriptive analysis and was represented in the form of frequencies and percentage.

### III. RESULTS

A total of 589 patients' implant reports were included in this study. 1220 implant placement surgeries have been reported. The age range of the study is 17 to 72 years. Results on categorical measurement were presented in percentage(%). The statistical software SPSS was used for the descriptive and inferential analysis. Results on categorical measurement were presented in percentage(%). The non parametric Chi square test was done to assess the association between the variables.  $P \leq 0.05$  was considered to be statistically significant.

Diabetes mellitus prevalence in the random blood sugar tested patients undergoing implant placement is 4.24%, hypertension prevalence is 2.2% and occurrence of diabetes mellitus and hypertension is 1.7%(Figure 1). This finding was statistically significant( $p=0.001$ ). In our study, implant placement was higher in prevalence in the age group of 25 to 40 years. But the incidence of diabetes mellitus is higher in the age group of 41 to 60 years(63%). These results were statistically significant( $p=0.001$ ) (Figure 2). Among the hypertension patients there is a higher incidence of implant placement among the age group of 41 to 60 years(76%) followed by the age group of above 60 years(24%).The results were statistically significant ( $p=0.001$ )(Figure 3). The joint occurrence of diabetes mellitus and hypertension also shows similar results with 68% occurrence in the age group of 41 to 60 years(Figure 4). The results were statistically significant ( $p=0.001$ ). There is no patient reported with systemic illness below the age of 25 years.

Gender distribution in the patients undergoing implant placement shows that there is higher prevalence of implant placement in male patients. Similarly, when compared with the diabetes mellitus patients the prevalence of male patients is 75% and female prevalence is 25% (Figure 5). This finding was statistically significant( $p=0.001$ ). In hypertension, 61% of male patients and 39% female patients have reported for implant treatment (Figure 6). This finding was statistically significant( $p=0.001$ ). The occurrence of diabetes and hypertension shows the male prevalence of 60% and female prevalence of 40% (Figure 7). There is an overall male prevalence in the patients undergoing implant treatment with diabetes mellitus and hypertension. The results were statistically significant with a p value of 0.001.

### IV. DISCUSSION

Dental implant surgery has developed to be a widely used procedure for dental rehabilitation(44)(45). It has proven to be a proper alternative for several decades in the treatment of partial or complete edentulism (46). Proper preoperative clinical and radiographic diagnosis is of utmost importance to achieve highly predictable esthetic and functional results [31,32](47). The clinician should assess the patient's medical and dental history for bruxism, metabolic diseases of bone, systemic illness or any periodontal problems(48). Improvements in implant design, surface characteristics and surgical protocols made implants a secure and highly

preferable procedure with a success rate of 89.7% and survival rate of 94.6% after more than 10 years(49).

Diabetes mellitus is a chronic disorder of carbohydrate metabolism characterised by hyperglycemia. It occurs when the pancreas does not produce enough insulin or when the body has increased insulin resistance(50). Blood glucose control is viewed as a critical parameter in identifying whether patients with diabetes are eligible for implant therapy. It has been reported that diabetic patients have increased marginal bone resorption and slower healing leading to higher dental implant failure. Clinical studies related to implant rehabilitation in diabetes patients reported survival rates ranging between 94.3% and 97.3% when followed upto 12 years(51). On the other hand, hypertension is also a serious risk condition for any patient undergoing implant treatment(52). The prevalence of hypertension among people over the age of 60 years can reach 66%, with more than half of them taking antihypertensive medications(53). Higher blood pressure has been reported to be associated with increased bone loss(54). This might be because hypertension is associated with abnormal calcium metabolism, including an increase in urinary calcium excretion(55). But bone formation is extremely important for osseointegrated dental implants because osseointegration follows a physiological process that resembles bone fracture healing, and is strongly influenced by bone metabolic activity(56). It has also been proved that the antihypertensive drugs also have a positive effect on bone, especially in bone formation, metabolism, and healing(57). It helps in maintaining alveolar bone microstructure and increases the bone mass and bone density(58). There is a decreased failure rate of 0.6% when compared to the non users of antihypertensive drugs. Now we are focussing on the preference of dental implants in these patients among different age groups and gender which will guide us in understanding the prevailing situation in the community.

According to our study, prevalence of diabetes and hypertension and the coexisting systemic illness of diabetes mellitus and hypertension in implant undergoing patients is more prevalent in the age group of 41 to 60 years, despite the overall prevalence of implant placement is higher in the age group of 25 to 40 years(fig2,3,4). This finding is in concordance with a study reporting that the prevalence of edentulism in the systemic illness patients undergoing implant treatment to be higher in the age group of 51 to 60 years(59). In our study the gender prevalence of diabetes mellitus shows that there is high prevalence in the male patients when compared to the female patients(fig 5). Similarly in hypertension, there's an increased prevalence among the male patients(fig 6). There is a higher incidence of male patients having systemic illness due to factors like poor oral hygiene, smoking, obesity, increased functional status of the body with lower hormonal levels leading to tooth loss than the females(60)(61).

The prevalence of Diabetes mellitus in implant patients is 4.2%, this finding is in accordance with a study proposed by Fiorellini(62) which shows that the success rates of dental implants in diabetic patients is 83% to 86%. Chronic hyperglycemia affects different tissue structures, produces an inflammatory effect and, in vitro, has been shown to be a stimulus for bone resorption(63). In addition, it produces a deleterious effect on the bone matrix and its components and also affects adherence, growth and accumulation of extracellular matrix(64).

Metabolic control is essential for osseointegration to take place, as constant hyperglycaemia delays the healing of the bone around the implants(65). It has been proved that insulin therapy allows regulation of bone formation around the implants and increases the amount of newly formed bone, when compared with non-diabetic groups(66).

Based on the degree of glycaemic control in the perioperative period and the existence of chronic vascular complications, the consequences of diabetes on the healing of soft tissue will vary. The vascularization of the flap may be compromised due to the microangiopathy of diabetes, thus delaying healing and acting as a gateway for the infection of soft tissue. Inflammatory reactions in the peri implant tissues have been associated with the presence of dental plaque around implants(18). An in vitro study showed that bacterial adhesion on implant surfaces has a strong influence on the healing and long-term prognosis of dental implants(67). Periodontal therapy has been shown to improve glycemic control in patients with diabetes. Effective treatment of periodontal infection and reduction of periodontal inflammation have been associated with a reduction in the level of failure rates of implants(68).

In our study, the prevalence of hypertension is 2.2% in the implant patients(fig 1). The success rate of dental implants in cardiovascular risk patients show a success rate of 85% - 92%(69). These patients during the implant placement time due to physiological stress tend to release cortisol which places the patient at greater risk for stroke(70,71). The patients taking anti hypertensive drugs produce erythema, gingival hyperplasia and are highly prone to infections in both normal dentition and dental implant patients(70). Though there is not much correlation between osseointegration and blood pressure apart from the reduced blood supply to the wound site, in general the anti hypertensive drugs help in the bone formation and remodelling and are associated with lesser risk of bone fractures(72). The prevalence of coexisting diabetes mellitus and hypertension in our study is 1.7%(fig 1). Rehabilitating with implant supported fixed prosthesis in patients with coexisting diabetes and hypertension show no significant differences in implant survival rates when compared with the diabetes patients without coexisting hypertension(73).

Individualized medical health care and the degree of systemic illness control may be far more important than the nature of the disorder itself, and it should be established prior to implant therapy. The finding of this study will have a significant impact among the oral health planners to help prepare more reliable preventive and health care measures in the patients with systemic illness. The study provides notable information regarding the prevalence of implant in diabetes mellitus and hypertension patients among different age groups and study. As this is a retrospective study, we were not able to gauge the HbA1C reports and the postoperative effect in these patients. This can be modified by performing longitudinal and periodic studies to evaluate the prevalence of diabetes mellitus and hypertension in implant patients. The present study includes a lesser sample size in a restricted geographic area of study which can be corroborated further with a larger population in a different ethnicity along with elaborate prospective surveys in creating awareness among the clinicians and patients about the implant treatment in systemic illness patients(73).

## CONCLUSION

Within the limits of the present retrospective study, we found that the prevalence of diabetes mellitus and hypertension among patients undergoing dental implant placement was higher in the male patients and more common in the age group of 40 to 60 years. Knowledge about the prevalence of these conditions will be helpful to the clinician for proper management setup and precise diagnosis before implant therapy can prevent surgical and postoperative complications resulting in long term success of dental implants.

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## AUTHORS CONTRIBUTION

Author 1(Vaishnavi Devi. B) carried out the retrospective study by collecting data and drafted the manuscript after performing the necessary analysis. Author 2(Dr. Priya Lochana Gajendran) aided in conception of the topic, has participated in the study design and has supervised in the preparation of the manuscript. Author 3(Dr. Delphine Priscilla Antony) has coordinated in critical evaluation of the manuscript. All the authors have contributed equally in the development of the final manuscript.

## CONFLICT ON INTEREST

Authors declare no potential conflict of interest.

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### **TITLE**

Figure 1: Prevalence of systemic illness in the patients undergoing dental implant treatment.

Figure 2: Distribution of different age groups in the diabetes mellitus patients undergoing implant treatment.

Figure 3: Distribution of different age groups in the hypertension patients undergoing implant treatment.

Figure 4: Distribution of different age groups in the diabetes mellitus and hypertension patients undergoing implant treatment.

Figure 5: Gender distribution in diabetes mellitus patients undergoing implant treatment.

Figure 6: Gender distribution in hypertensive patients undergoing implant treatment.

Figure 7: Gender distribution in diabetes mellitus and hypertensive patients undergoing implant treatment.

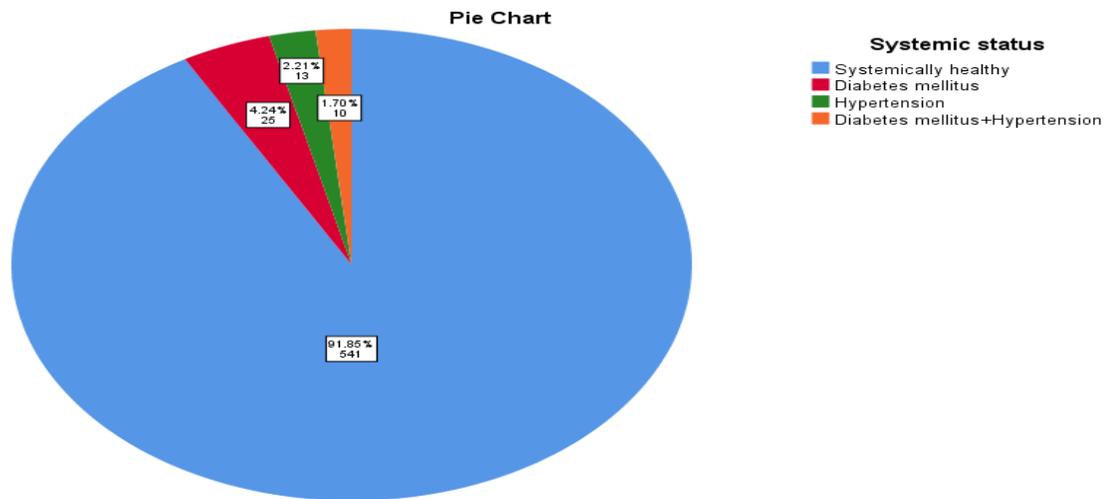


Figure 1. Pie chart showing the prevalence of systemic status of the patients undergoing implant treatment. The blue colour represents the systemically healthy patients, red colour represents the diabetes mellitus patients, green colour represents the hypertensive patients and the orange colour represents the coexisting diabetes mellitus and hypertensive condition. The prevalence of diabetes was 4.24%, hypertension was 2.21% and patients who had both diabetes and hypertension were 1.70%.

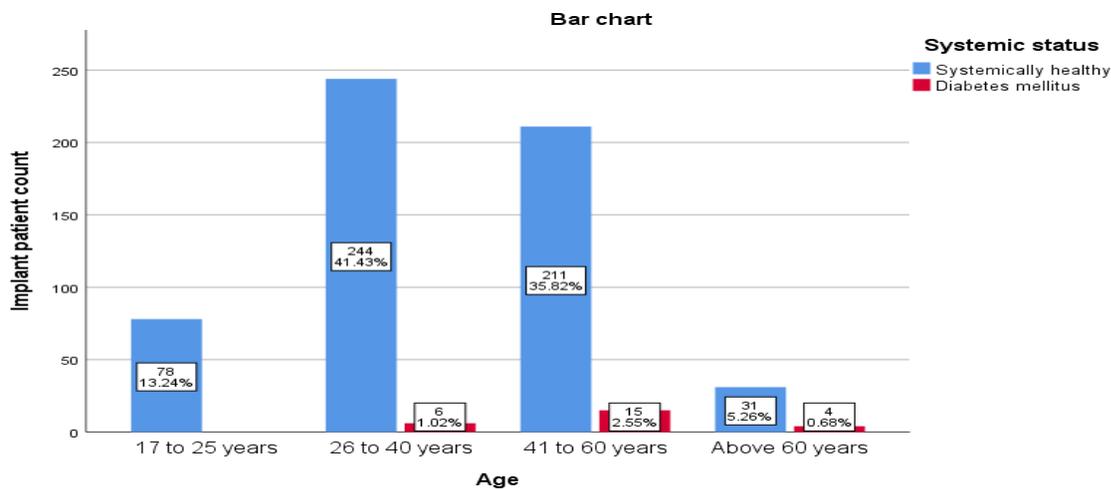


Figure 2. Bar graph showing the distribution of different age groups in the diabetes mellitus patients undergoing implant treatment. The x axis depicts the age prevalence of patients undergoing implant treatment and y axis represents the implant patient count. Chi square statistical test was done and the association was found to be significant with p value 0.001(p value  $\leq 0.05$ , statistically significant). There is a significant incidence of diabetes mellitus in patients undergoing implant treatment in the age group of 41 to 60 years when compared to the other age groups.

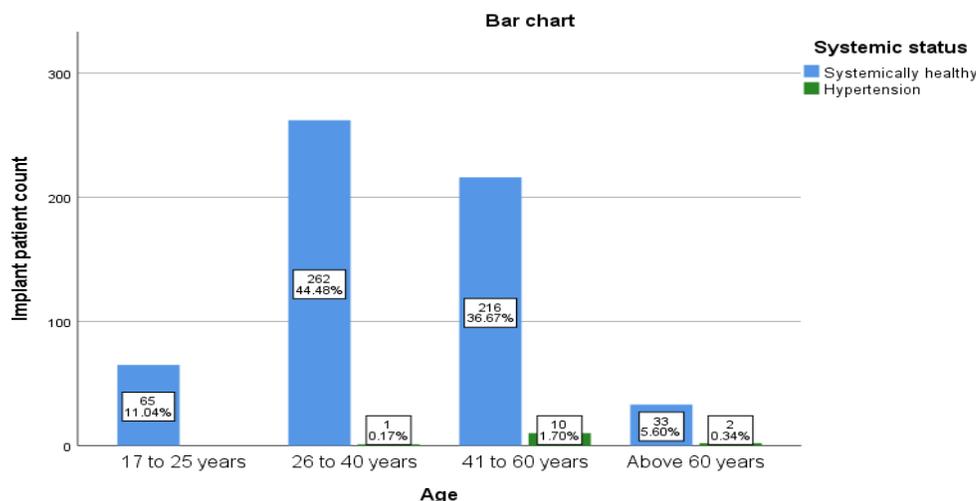


Figure 3. Bar graph showing the distribution of different age groups in the hypertension patients undergoing implant treatment. The x axis depicts the age prevalence of patients undergoing implant treatment and y axis represents the implant patient count. Chi square statistical test was done and the association was found to be significant with p value 0.001(p value  $\leq 0.05$ , statistically significant). There is a significant incidence of hypertension in patients undergoing implant treatment in the age group of 41 to 60 years when compared to the other age groups.

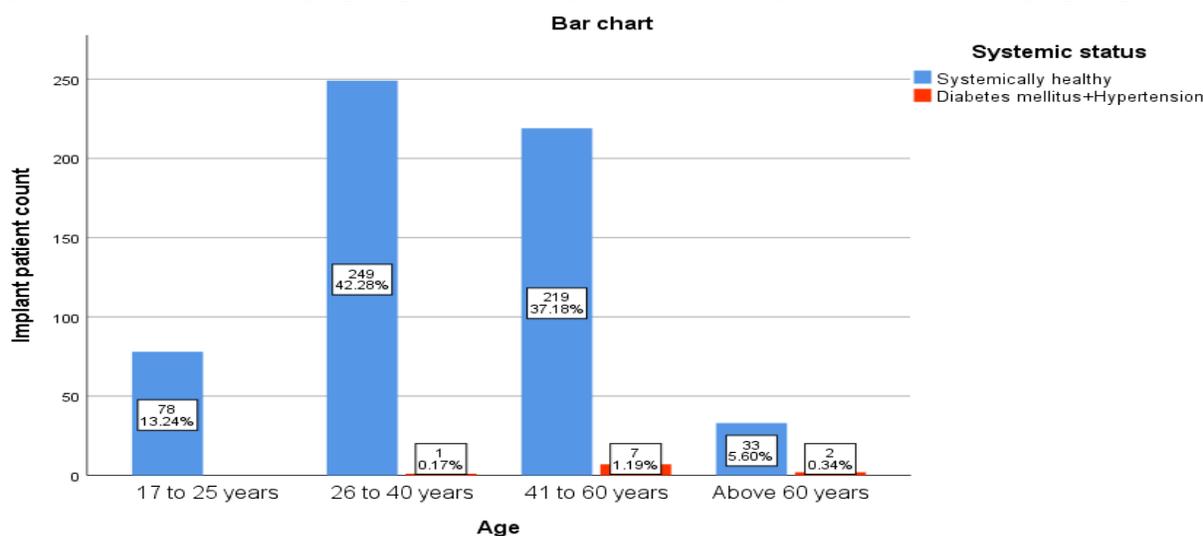


Figure 4. Bar graph showing the distribution of different age groups in the diabetes mellitus and hypertension patients undergoing implant treatment. The x axis depicts the age prevalence of patients undergoing implant treatment and y axis represents the implant patient count. Chi square statistical test was done and the association was found to be significant with p value 0.001(p value  $\leq 0.05$ , statistically significant). There is a significant incidence of diabetes mellitus and hypertension in patients undergoing implant treatment in the age group of 41 to 60 years when compared to the other age groups.

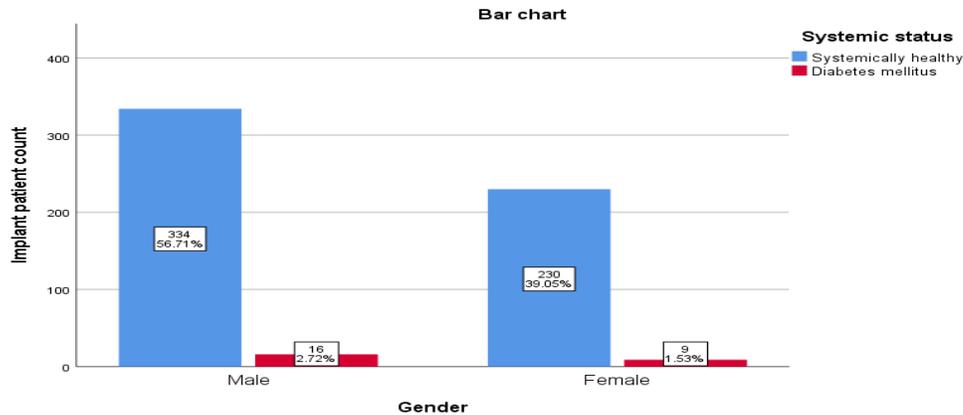


Figure 5. Bar graph showing the gender distribution in diabetes mellitus patients undergoing implant treatment. The x axis depicts the gender prevalence among diabetes mellitus patients undergoing implant treatment and y axis represents the implant patient count. Chi square statistical test was done and the association was found to be significant with p value 0.001(p value  $\leq 0.05$ , statistically significant). There is a significant incidence of male patients with diabetes mellitus undergoing implant treatment when compared to the female patients.

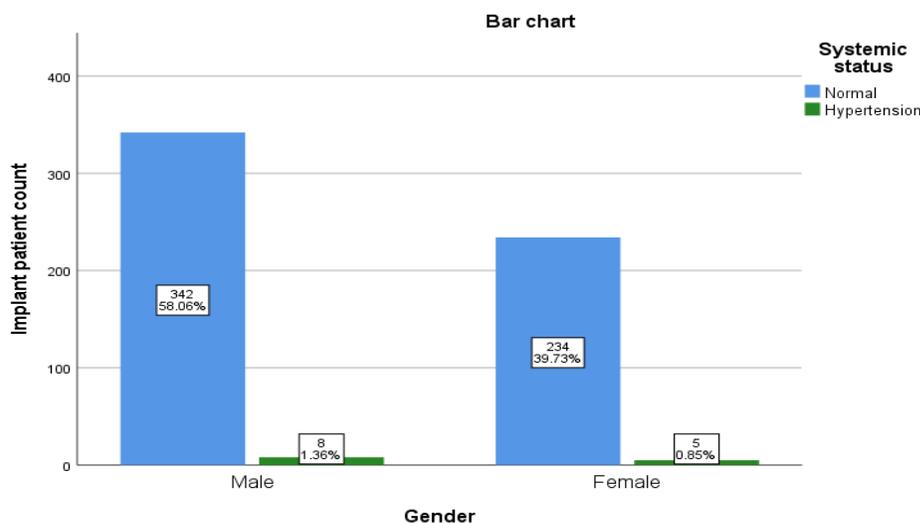


Figure 6. Bar graph showing the gender distribution in hypertensive patients undergoing implant placement. The x axis depicts the gender prevalence among hypertensive patients undergoing implant treatment and y axis represents the implant patient count. Chi square statistical test was done and the association was found to be significant with p value 0.001(p value  $\leq 0.05$ , statistically significant). There is a significant incidence of male patients with hypertension undergoing implant treatment when compared to the female patients.

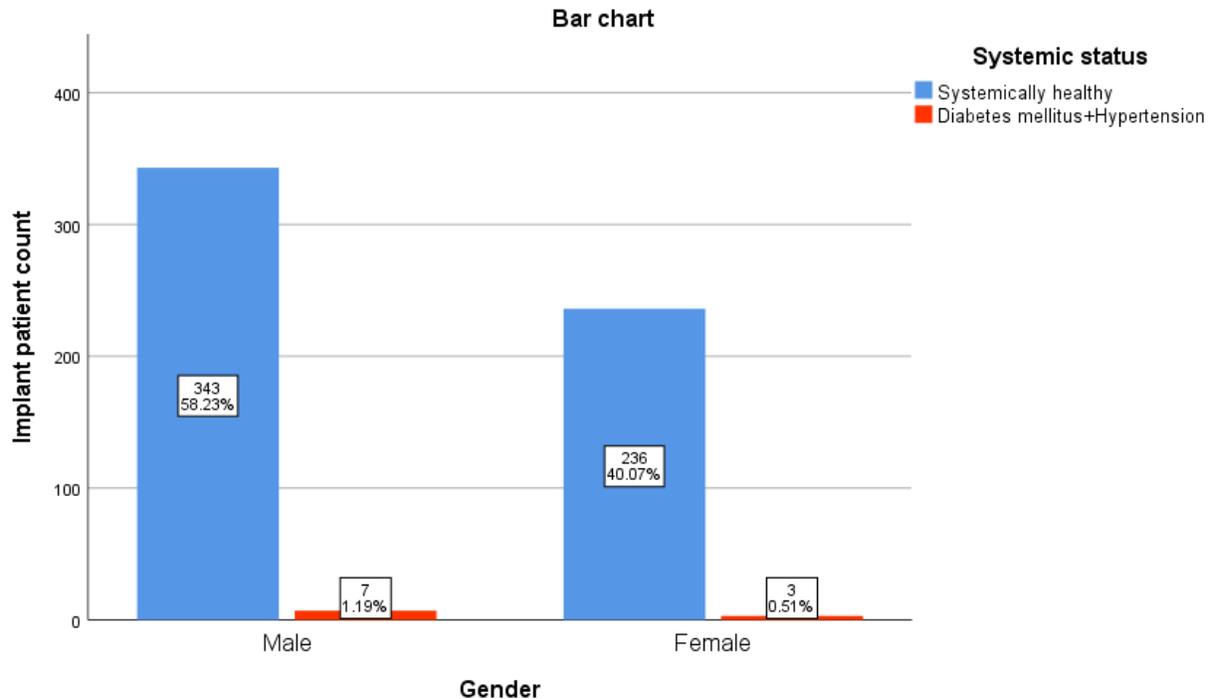


Figure 7. Bar graph showing the gender distribution in diabetes mellitus and hypertensive patients undergoing implant placement. The x axis depicts the gender prevalence among diabetes mellitus and hypertensive patients undergoing implant treatment and y axis represents the implant patient count. The blue colour represents the systemically healthy patients, orange colour represents the diabetes mellitus and hypertensive patients. Chi square statistical test was done and the association was found to be significant with p value 0.001(p value  $\leq 0.05$ , statistically significant). There is a significant incidence of male patients with diabetes mellitus and hypertension undergoing implant treatment when compared to the female patients.